

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW OF APPLIED MYCOLOGY

VOL. XX

AUGUST

1941

LINN (M. B.). **The yellows disease of Lettuce and Endive.**—*Bull. Cornell agric. Exp. Sta.* 742, 33 pp., 13 figs., 3 graphs, 1940.

A full account is given of a comprehensive investigation carried out from 1935 to 1939 in the greenhouses and on the farms of 25 members of the Staten Island Growers' Association, New York, into lettuce and endive yellows caused by the aster [*Callistephus chinensis*] yellows virus and transmitted by the leafhopper *Macrostelus divisus* [*R.A.M.*, xx, p. 209]. The average loss from lettuce yellows in New York State from 1921 to 1938 has been estimated at 5 to 6 per cent. of the normal crop, with losses attaining 70 to 80 per cent. in some fields. The reduction in yield for the United States as a whole is probably not over 2 per cent., as there are important lettuce-growing areas as yet unaffected. No difference in susceptibility was noticed in 23 varieties and strains of lettuce tested, and curled-leaf and broad-leaf endive were also demonstrated to be susceptible.

On lettuce the disease is marked, before heading, by yellowing, blanching, and curling of the inner leaves, along the margins of which small brown spots are found. Slight vein-clearing is often present. If the plants become affected after heading, the heart leaves are twisted, dwarfed, and curled, the head failing to become firm. There is as a rule an abnormal production of lateral, upright shoots in the leaf axils, these lateral branches often bending down. The flowers on diseased branches are dwarfed and distorted, and give dwarfed, sterile seeds, if any. On broad-leaf endive (escarole) the symptoms are similar, except that the vein-clearing and the twisting of the inner leaves are less conspicuous. On curled-leaf endive the chief symptoms are leaf yellowing and stunting of the whole plant.

On Staten Island the virus overwinters principally on *Plantago major*, whence it is carried by the vector to lettuce and endive. The vector, it is thought, may overwinter in the adult stage in some locality far removed from cultivated areas. Studies on the dispersion of the vector into and from weeds adjacent to endive beds showed that it is driven into the weeds during cropping, but that later on it may pass back to endive or other beds. Wind direction may influence the direction of vector movement, but the leafhoppers do not move in perceptible numbers much over 200 ft. in four weeks.

Appreciable control was obtained as a result of the eradication of weeds within 100 ft. of prospective lettuce and endive beds by means of

sodium chlorate crystals or spray, at a cost of \$33 to \$36 per acre of weeds. The roguing of affected lettuces in small plantings did not give satisfactory control. Dusting at weekly intervals from transplantation to harvest with pyrethrum-sulphur dust containing at least 0.15 per cent. pyrethrins, or with 1 per cent. rotenone-sulphur dust significantly reduced infection, an increase of only 5 per cent. in marketable heads in most cases defraying the cost of dusting. When young lettuce plants were protected from leafhopper attack by being grown in cloth-covered frames or screened greenhouses, a considerable reduction in yellows resulted at harvest.

LONGRÉE (KARLA). **Wilt of Salsify, caused by *Verticillium* sp.**—*Phytopathology*, xxx, 11, pp. 981–983, 1 fig., 1940.

In 1939 a species of *Verticillium* producing both torulose hyphae and sclerotia was isolated from a brownish discoloration of salsify (*Tragopogon porrifolius*) roots collected at Ithaca, New York, by H. H. Whetzel. The simultaneous development of both torulose hyphae and sclerotia by the fungus is of interest in view of the use of the presence or absence of sclerotia as a means of differentiating *V. dahliae* from *V. albo-atrum* [*R.A.M.*, ix, p. 6 *et passim*]. The only previous record of salsify wilt due to *Verticillium* is by Jagger and Stewart, also from New York (*Phytopathology*, viii, pp. 15–19, 1918). Inoculation experiments involving the immersion of seedling roots in a mycelial and spore suspension of the pathogen under controlled greenhouse conditions at a mean temperature range of 72° to 78° F. gave positive results in 12 out of 25 plants, the foliage of which wilted and the vascular tissues assumed a reddish- to greyish-brown discoloration, the fungus being reisolated from the roots.

SWARTWOUT (H. G.). **Spraying Grapes with special reference to black rot.**—*Circ. Mo. agric. Exp. Sta.* 211, 4 pp., 1941.

The following five-spray schedule is recommended for the control of vine black rot [*Guignardia bidwellii*] in Missouri, where it has likewise been found effective against anthracnose [*Elsinoe ampelina*]: (1) delayed dormant, when the buds have pushed out to a length of about $\frac{1}{2}$ in., 12–12–100 Bordeaux mixture; (2) first summer, when the new shoots are 8 to 12 in. long, or as the flower buds separate, 8–8–100 plus 3 lb. lead arsenate for chewing insects; (3) second summer, just before or as the blossoms begin to open, same as (2); (4) as the flowering period closes, same as (2); (5) 10 to 14 days after (4), same as (2) but reducing the lead arsenate content to 2 lb. or replacing by calcium arsenate. Spraying, in conjunction with thorough vineyard sanitation, is cumulative in its effect, and cases are on record in which the incidence of infection fell from 25 to less than 1 per cent. after the first season of treatment under equally favourable weather conditions for *G. bidwellii*.

L. (C. A. D.) & CANAL (F. P.). **Mildieu de la Vid.** [Vine mildew.]—*Rev. Fac. nac. Agron. Colombia*, iv, 10, pp. 1009–1036, 1 col. pl., 5 figs., 1941.

This is an account, based largely on the work of well-known European and American phytopathologists, of the history, distribution, sympto-

matology, life-history, mode of infection and dependence on environmental conditions, and control of vine downy mildew (*Plasmopara viticola*), which is stated to be prevalent in all the viticultural regions of Colombia.

FAES (H.) & STAEHELIN (M.). **De l'action accélératrice des bouillies cupriques sur l'évaporation de la pluie, du brouillard ou de la rosée mouillant les feuilles de la Vigne.** [Of the acceleratory action of copper mixtures on the evaporation of rain, mist, or dew moistening Vine leaves.]—Reprinted from *Chron. vitic.*, 1940, 8 pp., 1940.

Previous literature relating to the acceleration by copper-containing compounds of the evaporation of moisture from natural sources on vine leaves, considered as an indispensable adjunct to their fungicidal properties in connexion with downy mildew [*Plasmopara viticola*] control, is summarized, and a tabulated account is given of the writers' laboratory and field experiments in 1940 at the Swiss Federal Viticultural Station, Lausanne, to determine the relative value in this respect of some standard mixtures. It was found that adult vine leaves sprayed with Cadoret's 'blue' (alkaline) Bordeaux mixture (3 per cent. each of copper sulphate and lime) [*R.A.M.*, vii, p. 614] were dried after being wetted by rain in 1 hour 46 minutes, the corresponding periods for ordinary Bordeaux (2 per cent.), 1 per cent. cuprenox (copper oxychloride), and the untreated controls being 2 hours 6 minutes, 3 hours 9 minutes, and 3 hours 41 minutes, respectively. The consensus of opinion as regards the time required by *P. viticola* to induce effective infection of the foliage is that a minimum of $1\frac{1}{2}$ to 3 hours is necessary, hence in a great number of attacks the 'blue' mixture would inhibit the process. Notwithstanding the promising outlook for the use of this economical and effective treatment in Swiss vineyards, the writers strongly advise caution in the introduction of any essential modifications in the present spraying schedule. Small-scale experiments should be conducted in 1941 with a weak Bordeaux mixture (1 per cent. each of copper sulphate and lime) before proceeding further in the matter.

Fourteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1940.—102 pp., 1940. [Received June, 1941.]

This report [cf. *R.A.M.*, xix, p. 457] contains, *inter alia*, the following items of interest. When wheat was grown in 5 gal. soil-containers, in two seasons symptoms of whiteheads developed on plants in soil uncontaminated with fungi. As in other experiments in Australia and elsewhere, whiteheads have not been produced experimentally by soil contamination with *Ophiobolus graminis* and other organisms reputedly associated with the condition in the field, it is tentatively concluded that whiteheads are an expression of physiological trouble associated with the chemical composition of the soil [*ibid.*, xix, p. 457].

In experiments on the control of downy mildew [*Peronospora tabacina*: *ibid.*, xix, p. 733] in tobacco seed beds by means of benzol, solvesso compounds, and para-dichlorobenzene, the best results were given by the first-named, but solvesso I was very promising. The third

material failed to prevent the spread of infection, possibly owing to the low temperatures prevailing.

The most important of the less well-known virus diseases of the potato in Australia is one which is probably related to or identical with the American 'spindle tuber' [ibid., xx, p. 221]. Preliminary field surveys indicate that the chief insect vector of potato virus diseases in Australia is *Myzus persicae*. Greenhouse transmission tests demonstrated its ability to act as a vector of viruses A, Y, and leaf roll. Two types of potato wilts occur in the tableland areas of New South Wales, one associated with *Verticillium albo-atrum*, and found in the cooler areas, the other associated with a species of *Fusarium*, probably *F. oxysporum*, and present in the hotter areas. In Australia, *V. albo-atrum* spreads by root contact from plant to plant through the soil.

In most instances, pine trees treated individually or in small groups with boron compounds showed signs of recovery from needle fusion [ibid., xx, p. 40] during the first season after treatment, but reverted during the next season, unless the treatment was repeated. Trees similarly treated with superphosphate in most cases did not respond until the second season after treatment, but their recovery appeared to be more lasting. Inoculation tests indicated that while *Diplodia pinea* [loc. cit.] readily produces die-back of laterals and leaders on vigorous pine trees, the infections generally remain localized unless the tree has been weakened by unfavourable environmental conditions.

The incidence of internal cork of apples [ibid., xix, pp. 603, 659] was low in Tasmania in 1939, the effect of soil dressings of $\frac{1}{2}$ to 2 lb. of borax per tree having persisted for four years. Storage wastage was increased in Granny Smith, Delicious, and Democrat apples by a soil dressing of boron (4 lb. per tree) and 1 per cent. spray, but was not affected by a 1 lb. soil dressing or 0.25 per cent. spray. Soft scald in Jonathan apples can be controlled by storage at 36° F. until the end of April, 34° during May, and 32° subsequently. Serious outbreaks of Jonathan spot can be controlled by an atmosphere containing 5 per cent. carbon dioxide. Bitter pit [ibid., xix, p. 156] in immature Granny Smith apples was again controlled by pre-treatment with ethylene. Confirmation was also obtained that bitter pit in Granny Smith apples can be almost entirely controlled by picking the fruit when it is sufficiently mature and storing it at once at 32° to 34°. Bitter pit was much less in apples picked at the end of April than it was in those picked in the beginning of the month. Even in the more mature apples, however, considerable bitter pit developed if the fruit was left at outside temperatures for several days before being stored. When stored at once, the more mature apples remained almost unaffected until October. In cool storage tests with apples promising results were obtained by using a proprietary wax emulsion incorporated in wraps or as a dip, which retarded the rate of colour change, and reduced pit, Jonathan spot, and shrivelling.

Several years' experiments have afforded strong evidence that a storage temperature of 42° is generally the most satisfactory for the avoidance of excessive mould development [chiefly *Penicillium digitatum* and *P. italicum*: ibid., xix, p. 458] and storage spot [loc. cit.] on Victoria-grown Washington Navel and Valencia oranges. Careful

handling and the avoidance of late picking (after mid-July for Washington Navels) are also important factors. Investigation into wilting of oranges due to loss of water, which sometimes causes a considerable loss in the market value of the fruit, showed that wilting becomes apparent when the water loss exceeds about 5 per cent. of the initial weight. Most of the detergent and fungicidal solutions used for treating the fruit in the packing-houses cause heavy increases in the rate of evaporation of water from the fruit; in some cases this increase exceeds 100 per cent. Thorough rinsing with clean water greatly reduces the adverse effect of the detergent solutions when the oranges are carefully washed by hand, and the effect of rinsing in machine handling is now being studied. Evidence was obtained that one of the long-chain sulphionate detergents used commercially in Australia is an efficient cleanser, without appreciable effect on the rate of loss of water from oranges when it is used for washing by hand; when, however, it is used in one type of commercial machine, there is some increase in the rate of evaporation. The practice of coating oranges with wax after washing was found to reduce the rate of loss of water by about 40 per cent.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lii, 3, pp. 159–163, 1941.

In 1940, unsprayed citrus trees at Leeton, New South Wales, developed a moderate amount of *Septoria* spot [*S.* (?) *citricola*: *R.A.M.*, xix, p. 388] though the sprayed series was scarcely affected. Bordeaux mixture (2–4–80½) appeared to give as effective control as one at 4–4–80½, while combined zinc and copper sprays also gave good results.

Most of the Imperial lettuce varieties grown in New South Wales have been bred in California by crossing the New York lettuce with European varieties. When first released, Imperial D, Imperial F, Imperial 615, and Imperial 847 were resistant to downy mildew (*Bremia lactucae*) [*ibid.*, xix, p. 577], but all, owing to the appearance of a fifth strain of the fungus in California, became susceptible. This strain now appears to be present in Australia, since the disease commonly occurs on Imperial lettuces in New South Wales.

New records for New South Wales made in January, 1941, include brown rot of grapes (*Sclerotinia fructicola*) and strawberry leaf blight (*Dendrophoma obscurans*) [*ibid.*, xviii, p. 402], both in the Sydney metropolitan area.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lii, 4, pp. 210–213, 217, 3 figs., 1941.

The most serious disease of maize in New South Wales is root and basal stalk rot due to *Gibberella saubinetii* [cf. *R.A.M.*, xix, pp. 642, 699]. Field surveys have shown that in individual fields 25 to 30 per cent. of the plants may be infected, while in many instances, especially on old maize land, infections of up to 70 per cent. have been found. The control measures recommended consist in burning all the old stalks and plant debris left after harvest, crop rotation, and seed selection.

Bitter rot of apples (*Glomerella cingulata*) [*ibid.*, xviii, p. 235] is destructive to fruit at all stages, and may cause trouble in storage [*ibid.*, xviii, p. 784]. During the past summer and autumn, owing to

warm, humid, showery weather, infection was more noticeable and widespread in New South Wales than for several seasons previously. To control the disease all mummified and infected fruits should be burnt, the diseased twigs and badly cankered branches removed, the cankers scraped, and the wounds painted with $1\frac{1}{2}$ lb. copper sulphate and 1 lb. lime per 2 gals. water. All pome fruits should be sprayed with Bordeaux mixture ($1\frac{1}{2}$ –1–80) plus $\frac{1}{2}$ gal. white oil when approaching maturity.

New records for New South Wales in February 1941 include browning and stem break of flax and linseed (*Linum usitatissimum*) due to *Polyspora lini*.

WATERS (H. B.). Report on the Department of Agriculture, Gold Coast, for the year 1939–40.—6 pp., 1940.

During the period under review cacao swollen shoot [*R.A.M.*, xix, p. 521] made its appearance in the Many Krobo area, near Bisa, Gold Coast, at Tafo in the experimental plots, and also spread considerably in the area originally affected. The planting of shade and shelter trees was extended, and in the New Juaben-Akim Abuakwa area 13,000 acres were planted with 250,000 seedlings, while at the end of the year nurseries capable of supplying over 600,000 seedlings for planting in 1940 were established. Steps are being taken to survey the areas surrounding the original region of infection in the Eastern Province in order to prevent spread to Ashanti and the Central Province. Further evidence that the disease is of virus origin is provided by its spread and range under different conditions of shade, soil, and rainfall. A type of 'swollen shoot' in the Huhunya and Bisa areas associated with little or no die-back is being investigated to determine whether it is due to a mild strain of the virus or to environmental factors.

The banana Panama disease [*Fusarium oxysporum cubense*] situation is now under control. Cases discovered and treated dropped from 299 in the first, to 42 in the last, quarter of the year, all being found in the Western Province; the disease has not so far been reported from the Central Province. A banana disease resembling Wardlaw's 'water soak' occurred in the Eastern Province.

Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1940.—9 pp., 1941.

In Part I of A. H. Campbell's report on his investigations of sudden death of cloves in Zanzibar [*R.A.M.*, xviii, p. 615] the conclusion is reached that this disease is identical with apoplexy in Madagascar [*ibid.*, xviii, p. 548], both being of a purely functional (non-parasitic) character. The following factors are operative in the etiology of sudden death: (a) drought and inundation, (b) exceptionally heavy cropping, (c) root mutilation through irregular cultivation and damage to branches from the picking of heavy crops, and (d) the effect of opening the canopy on the water balance of the tree and on soil conditions. All these factors are thought to be concerned in the development of epidemics of the disease, but the last-named plays no part in sporadic outbreaks. In old plantations, epidemics of sudden death are prevalent, owing to accentuation of factors (a), (b), and (c), and the breaking of

the canopy in an over-mature stand, already on the verge of extreme water strain. As a result of the canopy break an area of soil partially occupied by the roots of adjoining trees is exposed to the full drying power of the sun, humus is destroyed, the evaporation from the exposed soil is increased, and the rise in temperature of the soil may be expected to exert an adverse effect on the absorbing capacity of roots of the superficial root plate, or even to kill them. At the same time, the leaf surfaces of the trees round the margins of the break are more fully exposed than before, resulting in increased transpiration and diminished water absorption, with consequent extensive wilting and death. No economical method of preventing sudden death being practicable, the problem resolves itself into one of regeneration.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1939-40, Part I, pp. 132-151, 5 figs., 1940.*

This report on plant disease work in Iowa in 1939-40 [*R.A.M.*, xix, p. 326] contains, *inter alia*, the following items of interest. Further studies by S. G. Younkin and I. E. Melhus on damping-off of water-melons [*loc. cit.*] showed that in the first six weeks after planting 65 per cent. of the seedlings died. Loss was greatest while the seeds were germinating, at which time the soil temperature was well under 70° F., and Pythiaceae fungi were isolated from most of the affected seedlings. After 12th May, the mean soil temperature was over 70° and losses declined; *Rhizoctonia* and *Fusarium* spp. only were isolated from these seedlings. The evidence suggested that *Pythium irregulare* was the primary cause of losses before 12th May. The *Pythium* was observed to be destructive only in cool soils and experimental evidence indicated that high soil temperatures do not eliminate the fungus from the soil but in some manner reduce seedling injury.

H. C. Murphy states that the new oat varieties Boone, Marion, and Hancock, first distributed to Iowa farmers for growing in 1940, are resistant to the endemic races of loose and covered smut [*Ustilago avenae* and *U. kolleri*: *ibid.*, xix, p. 327] and to races 1, 2, and 5 (but not 8) of stem rust [*Puccinia graminis avenae*]. Boone seems to be adequately resistant to all 54 races of crown rust [*P. coronata*: *loc. cit.*] known in North America, except the relatively rare ones 41, 50, 52, and 53. Numerous homozygous, high-yielding, crown rust-, stem rust-, and smut-resistant selections possessing resistance to race 8 of stem rust are under test. *Avena brevis*, C.I. 3436, recently introduced from Brazil, was resistant to stem rust, including race 8, and also to crown rust, under field conditions in 1939. Before 1938, races 1 and 7 of crown rust had been the most prevalent and widely distributed races since 1927, but in both 1938 and 1939 races 1 and 6 were by far the most dominant.

A survey in the spring of 1940 of sweet potato hot-beds showed the presence of cortical lesions on the older roots and stems when the slips reached a height of about 6 in. Other lesions were present at the end near the root tips. In isolation tests from plants gathered on 1st June stem lesions gave *R. [Corticium] solani*, *Fusarium* spp., and *Penicillium* spp., while those near or at the root tip gave species of *Pythium*,

Fusarium, and *Trichoderma*. It is evident that parasites are borne from the hot-bed to the field in the slips.

G. C. Kent and I. E. Melhus state that strains of apple blight (*Bacillus amylovorus*) [*Erwinia amylovora*] uniformly required complex forms of nitrogen to survive in culture. Comparative tests showed that *B. tracheiphilus* [*E. tracheiphila*] and *B. salicis* [*Bacterium salicis*: *ibid.*, xx, p. 94] behaved similarly, while the *B. carotovorus* [*E. carotovora*] group were all capable of utilizing inorganic nitrogen in the form of nitrates or ammonium salts as well as simple amino or amide forms after five successive transfers at 48-hour intervals on the synthetic medium.

I. E. Melhus, J. N. Martin, C. S. Reddy, W. F. Buchholtz, and H. C. Murphy state that *Pythium de Baryanum* [*ibid.*, xix, p. 328] caused a serious root rot of oats at 20° C. and below, infection being particularly serious between 10° and 15°. Swedish Select oats grown to maturity in infected soil averaged 36.3 seeds per plant, as compared with 81.7 for plants grown in steamed, uninfected soil. The latter plants were, on an average, 10 in. taller than the former, tillered one to two weeks earlier, and at maturity gave approximately twice as much dry weight of roots and tops.

Owing to dry weather in May *Pythium* root disease of maize [*loc. cit.*] did not appear to be serious in Iowa in 1939 except in certain localities where soil moisture favoured infection. Isolations at Ames and Kanawha from root lesions of seedlings from early plantings gave *Pythium* cultures to the extent of only 1 to 2 per cent. Root isolations from later plantings made early in June and showing leaf yellowing and dwarfing gave 18 and 12 per cent. *Pythium* at Ames and Kanawha, respectively. Other fungi found among the isolates were *R. [Corticium] solani*, *Gibberella saubinetii*, *Helminthosporium sativum*, and *Fusarium* sp. In all, 87 *Pythium* isolates were found, of which four were *P. de Baryanum* and the remainder *P. graminicola*.

I. E. Melhus, C. S. Reddy, W. F. Buchholtz, and E. L. Waldee state that tip rot of sugar beets (*Aphanomyces cochlioides*) [*loc. cit.*] was reported to be severe only in three fields, and in all three sugar beets had been planted more frequently than once in four years. A field showing severe infection in 1932 was again planted to sugar beets in 1939; it showed no tip rot, though an adjacent plot, planted to sugar beets at intervals in the same period, was severely infected. *Amaranthus retroflexus* and *Chenopodium album*, two common weeds in northern Iowa, proved to be as susceptible as sugar beet. In laboratory plantings of sugar beets in field soil infested with *A. cochlioides* and *P. de Baryanum*, infection by the latter was confined to germinating seed and young seedlings, and was partly controlled by seed treatment, whereas infection by the former did not occur on germinating seed, but completed the destruction of seedling stands from both treated and untreated seed.

Of six commercial sugar beet varieties tested in the field, U.S. 200×215, and American Nos. 1936 and 5 were least susceptible to *Cercospora* leaf spot (*C. [beticola*: *ibid.*, xix, pp. 327, 687]).

I. E. Melhus states that blight due to *Phomopsis juniperovora* [*ibid.*, xix, pp. 179, 444] makes it almost impossible to grow red cedar [*Juni-*

perus virginiana] nursery stock in Iowa. Leaf spot diseases of green and white ash due to species of *Cylindrosporium* and cherry shot hole (*Coccomyces hiemalis*) continue to prevail on nursery stock. After inflicting heavy damage in recent years, these two diseases are now satisfactorily controlled by means of Bordeaux mixture (3-4-50) or 2 per cent. lime-sulphur.

Research aids Utah agriculture. Biennial report 1938-1940.—*Bull. Utah agric. Exp. Sta.* 294, 119 pp., 54 figs., 2 graphs, 1 map, 1940.

In this report on plant disease work in Utah from 1938 to 1940 [cf. *R.A.M.*, xiv, p. 681], it is stated that a new selection of spring wheats from the Federation $\times$ Hope cross is highly resistant to all races of bunt [*Tilletia caries* and *T. foetida*], loose smut [*Ustilago tritici*], and rust [*Puccinia* spp.], and is being tested by a few farmers in the spring of 1941. Among the strains of wheat resistant to smut developed at Logan, the pure line Turkey 926, tested at Nephi under dry land conditions, proved superior and is now being distributed to farmers.

In field inoculations of approximately 130,000 lucerne seedlings with the bacterial wilt organism, *Phytophthora* [*Aplanobacter*] *insidiosum* [ibid., xix, p. 709], resistance was found in all varieties and strains employed: in Utah Pioneer from 12 to 20 and in Turkestan No. 96696 from 40 to 50 per cent. Isolations from lucerne stems exhibiting symptoms of stem blight or black stem yielded two organisms: *Pseudomonas* [*Bacterium*] *medicaginis*, which is believed to be the primary cause of the disease, and an *Ascochyta* sp., probably a secondary invader.

Verticillium wilt (*V. albo-atrum*) [ibid., xv, p. 519] is stated to be the most prevalent and serious disease of the tomato in Utah. No commercial variety could be found with more than a moderate degree of resistance, but two red-fruited wild tomatoes from southern Peru, *Lycopersicon esculentum* var. *cerasiforme* and *L. pimpinellifolium*, exhibited a degree of resistance closely approaching immunity, and one green-fruited species from central Peru, *L. glandulosum*, appeared to be practically immune from the disease. Hybrids from commercial tomato and the *cerasiforme* variety, which were readily obtained, exhibited fair fruit size and high resistance to the disease in the third generation and are being back-crossed to commercial tomato to increase size and quality. *L. pimpinellifolium* and the green-fruited species have been only recently included in the breeding programme.

Seed treatment trials showed that the extraction of tomato seed by fermenting the highly macerated fruit pulp containing the seed for 96 hours, or a seed soak in 0.9 to 1 per cent. acetic acid for 24 hours before the seed has been dried following extraction, to be the most effective treatments for the control of bacterial canker (*Aplanobacter michiganense*) [ibid., xviii, p. 765]. Survey data indicate that infested seed-beds are the most serious single source of bacterial canker infection. The complete destruction of the infested bed and the erection of a new one with new, clean soil situated far enough from the old site are recommended. Before being used again, old bed frames and sash covers should be thoroughly washed in a 3 per cent. formaldehyde solution and canvas and cloth covers laundered. Longevity studies

showed that *A. michiganense* will remain viable in air-dried plant tissue for over five years.

None of the strains or varieties of commercial tomatoes tested for resistance to the curly top virus (western yellow blight) [ibid., xiv, p. 339] in trial plots situated in the midst of a large insect-breeding area proved sufficiently resistant to the disease. Selections of a Mexican wild tomato, Ojo de Venado, were highly resistant to both the virus and drought, and a dwarf selection of the novelty tomato Red Peach was fairly so. Some of the green-fruited types of tomato introduced from South America in 1937-8 seemed to be more highly resistant to the curly top virus than the red-fruited wild or novelty types of *L. esculentum*, e.g., strains of *L. glandulosum* and *L. peruvianum* vars. *humifusum* and *dentatum*. Repeated attempts to cross the green-fruited types with commercial tomatoes failed, but crossing *L. hirsutum* with the resistant green-fruited types met with some promise of success. Through a series of re-combinations of hybrids it is hoped to unite the resistant qualities of the green-fruited types with the commercial advantages of *L. esculentum*. Direct seeding by means of the drill method reduced curly top infection from 6.5 per cent. in the control to slightly over 1 per cent. and increased the yield by 1½ tons. Early planting proved more advantageous than midsummer or late planting: tomatoes planted about 20th April showed only 5 per cent. curly top infection as against 20 per cent. in those planted in May. The highest yields and the best disease control were obtained with densely planted plots.

Survey results show that western celery mosaic [ibid., xix, p. 693] has become generally established in Salt Lake county, where it is estimated that 75 per cent. of the celery fields were affected during 1939, sometimes to a degree of approximately 100 per cent. infection. In heavily infested fields the yield was decreased by 50 per cent. A member of the carrot family was found generally distributed in the mosaic-infested areas and is suspected of harbouring the virus.

Cherry leaf mottle [ibid., xv, p. 664] has been found generally distributed in orchards, affecting from about 1 to 26 per cent. of the trees. The disease attacks both leaves and fruits and decreases the yield and quality of the fruit. No definite proof of transmission has as yet been obtained, but pending further research results, it is recommended to remove severely diseased trees.

The suspected 'X' disease or yellow-red virosis [ibid., xx, pp. 213, 310] is stated to have spread from a few limited chokecherry [*Prunus virginiana*] areas to adjacent peach orchards of Box Elder, Weber, and Davis counties, where the average incidence of infection was 23.2 per cent. of trees, but some orchards showed over 40, 50, and up to 68 per cent. infection. The disease is apparently becoming a major problem in peach production and it is expected that control will prove difficult and costly.

Fiftieth Annual Report for the fiscal year ended 30th June, 1940.—

Bull. Wash. St. agric. Exp. Sta. 394, 124 pp., 1940. [Received May, 1941.]

The section of this report dealing with plant pathology (pp. 70-78) [cf. *R.A.M.*, xviii, p. 440] contains the following items of interest, apart

from those already noticed from other sources. In work by C. S. Holton, F. D. Heald, and E. F. Gaines three additional races of *Tilletia tritici* [*T. caries*] and two of *T. levis* [*T. foetida*] were identified, bringing the total of the former to 14 and of the latter to 10. It was ascertained that race and species hybrids of *Tilletia* may give rise to some races equal in virulence to one parent or the other, some less virulent than either parent, some which possess the combined virulence of both, and some with a degree of virulence not shown by either. Segregation of factors for smooth and reticulate spores was observed in species hybrids. Oro × Tenmarq was found to be highly resistant to all races except L 8; the Oro race and Utah selection 122 A 70-3 were highly resistant to all races tested, while the spring wheat variety Flomar was susceptible to all the races used, except the Hohenheim races T 9, 10, and 12.

The same workers ascertained that five new C.I. oat varieties Ban-nock, Merion, Hancock, Boone, and Fulton were highly resistant to 40 races and collections of *Ustilago avenae* and *U. levis* [*U. kolleri*] [ibid., xix, pp. 271, 526]; only one collection infected Boone (1 per cent.) and only one infected Merion (3 per cent.). Seven races of buff smut resulted from mutation and hybridization. Factors for powdery and indurate types of sori in *U. avenae* segregated and recombined on a 3 : 1 ratio basis, the powdery factor being dominant.

Limited tests by F. D. Heald and J. D. Menzies indicated that the larger part of the surface of washed apples is, under normal conditions, almost free from *Penicillium expansum* [ibid., xix, p. 712] spores. The spore load of the fruit is chiefly confined to the calyx and within the calyx canal. Inoculation of open lenticels during ordinary handling is uncommon. The amount of inoculum may, perhaps, be a more important factor in lenticel infection than susceptibility of the lenticels. Of various methods of inoculating lenticels, dusting the spores over the surface of the apple with a dry cotton swab was the most satisfactory.

In further studies of 615 isolations from rotting pears H. English and F. D. Heald obtained 75 distinct species or strains of fungi belonging to 22 genera. Twenty-two species in 15 genera are recorded for the first time as causing pear rot in North America, and of these, *Hormodendron pyri*, *Mucor pyri*, and *Aspergillus pyri* are considered to be new species [but are not described]. To *Penicillium* belonged over half the fungi isolated, *P. expansum* being the commonest. Grey mould, due to various strains of the *Botrytis cinerea* complex was the next most frequent. At room temperature, the most rapid decay was caused by *Rhizopus nigricans*. Inoculations with a spore suspension of *P. expansum* on Bartlett pears gave numerous lenticel infections at room temperature, but at cold storage temperature no infection developed. Anjou pears were successfully infected through the lenticels with spore suspensions of 11 out of 17 isolates at room temperature, but in cold storage by only six. High humidity increased the number of lenticel infections at room temperature, but gave little increase in cold storage.

Of eight distinct physiologic races of *Ustilago bullata* [ibid., xx, p. 121] found by G. W. Fischer, race 1 is common in the Pacific Northwest on *Agropyron pauciflorum*, *Hordeum jubatum*, and *H. nodosum*, though the known host range comprises the genera *Elymus* and *Sitanion*.

Races 5 and 7 are common on mountain brome grass [*Bromus*] and related species in the west, and infect also other *Bromus* spp., *Elymus canadensis*, *E. sibiricus*, and *Hordeum nodosum*. Tests demonstrated that concentrations of 0.65 to 10 gm. of smut spores per l. of water in the inoculum greatly reduced the stand of inoculated plants without increasing the percentage of infection; concentrations of 0.003 gm. per l. gave comparatively high percentages of infection. Cultures of 40 collections of *U. bullata* on agar media showed it to be a composite species consisting of a number of broadly different cultural types, which also differed pathogenically. Two cultures of the same parentage but of opposite sex frequently differed so widely in cultural characters as to seem completely unrelated. *U. bullata* was hybridized with *U. nigra*, *U. hordei*, and *U. striaeformis* and F_1 spores obtained. Ceresan and new improved ceresan were effective against *U. bullata* in preliminary tests.

Greenhouse inoculations of species of *Agropyron*, *Elymus*, *Hordeum*, *Lolium*, and *Sitanion* with 25 collections of *U. hordei* gave positive results on *A. caninum*, *E. sibiricus*, *E. glaucus*, *H. jubatum* var. *caespitosum*, *H. nodosum*, and *S. hystris*. No noticeable differences were seen in the comparative virulence of the collections, many of which were definite races of *U. hordei*.

Inoculations of *Agropyron* and *Elymus* spp. with *T. caries* and *T. foetida* resulted in the infection of certain species of *Agropyron* and *E. glaucus*, the latter being a new host for wheat bunt.

L. Campbell states that in field tests made at planting time formaldehyde dust, calcium cyanamide, new improved ceresan, and hydrated lime at the rate of 150, 135, 6, and 700 lb. per acre, respectively, each with commercial fertilizer mixed by hand into the soil to a depth of 1½ to 2 in. in strips 3 to 4 in. wide significantly reduced black root [*Phoma betae*: *ibid.*, xix, p. 132] and gave an important increase in the number of healthy plants.

Investigations by L. Campbell and C. D. Schwartze indicated that running-out of strawberries is due to yellows [xanthosis: *ibid.*, xix, p. 107] and crinkle [*ibid.*, xix, p. 645], and to root rots (black root). Yellows in serious proportions is most prevalent throughout Pierce County, where it commonly so reduces the longevity of the plantings that only one profitable crop can be gathered. Crinkle is more widely distributed, but less destructive. Root rot may be found in nearly all commercial fields, and is found in the Western Washington Experiment Station plots where it seriously interferes with strawberry-breeding work. Red stele (*Phytophthora* sp.) [*ibid.*, xix, pp. 550, 608] occurs on heavy, poorly drained sites, but is not likely to prove of importance.

L. K. Jones states that as all commercial carnation stocks appear to be infected with the yellows virus, attempts have been made to develop virus-free seedlings for use in further investigations on the nature of the disease. Seedlings from 69 crosses have been studied, and four promising new varieties have been propagated to 9 to 12 plants each. The virus was shown to be transmitted from affected plants to healthy seedlings by aphids [unspecified], grafting, and mechanical inoculation. When Patrician plants were grown in neutral peat to which nutrient solutions were added, low nitrogen, phosphorus,

or potash availability aggravated the severity of the symptoms, as compared with high availability of all nutrients. Fifty-seven commercial varieties showed marked differences in susceptibility, the following showing the least injury: *Admiration*, *Carlotta*, *Dairy Maid*, *Joan Marie*, *Mrs. Sims*, *Pink Abundance*, *Rosalie*, and *Vivian*.

Department of Plant Pathology.—*Rep. agric. Res. West. Wash. Exp. Sta., 1939-40*, pp. 37-42, 1940.

Transmission studies carried out by G. A. Huber and K. Baur are reported on a number of red raspberry seedlings selected in co-operation with the Department of Horticulture as resistant or partially resistant to *Amphorophora rubi*, the aphid vector of red raspberry mosaic [*R.A.M.*, xx, p. 69]. The results show that no plants from these selected seedlings became infected with mosaic when viruliferous aphids were placed on the plants without bagging, but infection occurred following inoculation by bark grafting. In most cases, aphid-resistant seedlings resulting from a cross between aphid-resistant and aphid-susceptible parents showed mosaic symptoms similar to those on the aphid-resistant parent, while aphid-susceptible seedlings showed symptoms similar to those on the aphid-susceptible parent. When bark grafts from black raspberry [*Rubus occidentalis*] plants infected with mosaic were made to the red raspberry varieties *Lloyd George* and *Cuthbert*, no mosaic symptoms appeared, but when bark grafts were made from the inoculated red varieties to the *Cumberland* black raspberry, 90 per cent. of the plants showed the typical black raspberry mosaic symptoms. Several black raspberry seedlings grown from seed of apparently mosaic-free plants showed definite ability to escape infection by resistance either to the vector or the virus.

A number of young *Lloyd George* red raspberry plants showed a disorder characterized by somewhat stunted canes with the terminal leaves forming a rosette, the leaves being generally wrinkled with the tips curled down and remaining close to the canes. The disease was transmitted by bark grafts to healthy *Lloyd George* plants, but failed to infect *Cuthberts* or *Cumberlands*.

Further studies by the same workers on the brown rot of stone fruits in Western Washington [*ibid.*, xx, p. 24] revealed that two species, *Sclerotinia fructicola* and *S. lara*, are responsible for the disease. Inoculations showed that both species caused blossom blight on apricot, cherry, and peach, but not on Italian prune; only *S. lara* caused twig blight on apricot, cherry, and peach; and both species caused fruit decay of apricot, cherry, peach, and Italian prune. Apothecia were produced only by *S. fructicola* and were found only on Italian prune mummies overwintering on the ground. Trials conducted in prune orchards in Clark county during the springs of 1939 and 1940, showed that commercial pulverized and oiled calcium cyanamide, applied at the rate of 200 to 300 lb. per acre to the surface of the soil and vegetative cover just before the opening of the first blossoms, prevented the development of the apothecia of *S. fructicola*. Material applied on 13th March during rainy weather failed to remain toxic during the period of apothecial development, whereas later applications retained their toxicity throughout this period. In dusting experiments against

fruit decay, kolodust afforded better protection than other sulphurs tested; ground and sublimed sulphurs caused a reduction in fruit size, whereas hydrated lime conferred excellent protection on the fruit and caused no reduction in size.

A survey by K. Baur and G. A. Huber showed that boron deficiency occurs in a large part of the 15,000 acres of lucerne in Western Washington [ibid., xvii, p. 344], on 13 different soil types. In pot culture and field trials the deficiency was corrected by additions, either in spring or in autumn, of 50 to 60 lb. of borax per acre to silt and clay loam soils and 30 to 40 lb. to the lighter soils.

Plant pathology. —*Rep. Hawaii agric. Exp. Sta., 1940*, pp. 67–74, 5 figs., 1941.

In this report on plant disease work in Hawaii in 1940 [cf. *R.A.M.*, xix, p. 460] it is stated that the papaw virus disease reported in 1939 [ibid., xviii, p. 693] did not recur, but was kept alive in the greenhouse by artificial inoculation. The virus appeared to tolerate at least one hour in solution and a 1 in 20 dilution, and was transmitted from and to papaw by inarch grafting.

Control of papaw anthracnose (*Colletotrichum gloeosporioides*) [ibid., xix, p. 664] was obtained by spraying the fruits at 14-day intervals, beginning in November, with Bordeaux mixture (4–4–50), cuproside 54, or cuproside 54 Y. The fruits sprayed with Bordeaux mixture, however, became so russeted as to be unsaleable, while the foliage of these trees was also injured. Nearly all the fruits on the unsprayed trees were valueless owing to severe infection.

Phytophthora parasitica was observed in one district causing appreciable destruction of papaw fruits and killing the top third of some 50 per cent. of the plants in a four-acre planting. The affected fruits dehisced prematurely and mummified. Inoculation experiments demonstrated that the fungus is a virulent wound parasite of the stems and a weak wound parasite of the roots of papaw. Trees of all ages were found to be attacked.

Napier or elephant grass (*Pennisetum purpureum*) throughout the Territory was infected by a species of *Helminthosporium* which killed the leaves and stems. Heavily attacked plantings were almost useless as forage. The condition occurred at all elevations from sea-level up to a height of 2,500 ft. and appeared to be more or less unaffected by differences in rainfall.

Studies on the use of semesan and cuprous oxide (red copper oxide) against damping-off of various crops caused mainly by species of *Pythium* and *Rhizoctonia* showed that semesan should be employed for cauliflower, kale, turnip, cucumber, squash, okra [*Hibiscus esculentus*], lucerne, and pea, while either semesan or red copper oxide can be used on Swiss chard [*Beta vulgaris* var. *cicla*].

Other diseases noted during the year included powdery mildew of papaw, due to *Oidium caricae* [ibid., xviii, p. 506].

SMITH (C. O.). **Olive knot induced on species of the Oleaceae by artificial inoculations.**—*Phytopathology*, xxxi, 4, pp. 361–362, 1 fig., 1941.

Positive results were obtained at the California Citrus Experiment

Station in inoculation experiments with pure cultures of *Phytomonas* [*Pseudomonas*] *savastanoi* [*R.A.M.*, xviii, p. 825] on olive, *Olea capensis*, *O. verrucosa*, *O. ferruginea*, *O. laurifolia*, *Forestiera neomexicana*, *Osmanthus americanus*, and *O. aquifolium*. *Phillyrea decora* developed abnormal overgrowths but not the typical knots produced on the other Oleaceae included in the trials. No infection developed on *Ligustrum* and *Syringa* spp.

STEENBJERG (F.). **Das Kupfer im Boden mit besonderer Bezugnahme auf die Heidemoorkrankheit.** [Copper in the soil with special reference to the reclamation disease.] *Tidsskr. Planteavl.*, xlv, pp. 259-368, 1940. [Danish. Abs. in *Chem. Zbl.*, cxii (i), 13, p. 1724, 1941.]

As a result of five years' study of the relevant literature and personal observations, the writer concludes that copper is an indispensable plant nutrient, the absence of which is the cause of reclamation disease [*R.A.M.*, xviii, p. 668; xx, p. 297], expressed by chlorosis of the leaf tips of oats, barley, and other cultivated plants. Soil analyses showed that the available copper is at a minimum at a P_H between 5.5 and 6.5. The copper content of the various crops was found to range from 2 to 10 mg. per kg. dry weight, reaching a maximum in leafy plants and falling to a minimum in mangolds and cereals. The influence of the preceding crop on the availability of copper is very variable, that of meadow being the most propitious for this as for other 'trace' elements. Different crops have varying copper requirements, and one making excessive demands on this mineral should never immediately follow another of similar constitution. Desiccation of the soil reduces the amount of copper available to the plants, whereas steam sterilization enhances it. Copper deficiency can be remedied by the application to the soil of coke ash (which likewise exerts a beneficial effect on other 'trace' element deficiencies), compost, stable manure, copper sulphides, finely ground metallic copper, and clarified sludge containing a low percentage of copper [*ibid.*, xviii, p. 667], but further field experiments are necessary for the final solution of this aspect of the problem.

NIESCHLAG (F.) & WESTERHOFF (H.). **Eine kupferhaltige Schlacke als Ersatz für Kupfersulfat in der Bekämpfung der Heidemoorkrankheit.** [A copper-containing slag as a substitute for copper sulphate in the control of reclamation disease.]—*Bodenk. u. PflErnähr.*, N.F., xx, pp. 225-247, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2306, 1941.]

The outcome of experiments at the Oldenburg Agricultural Research Station indicated that equal quantities of copper, whether contained in copper sulphate or in copper slag, are equally effective against reclamation disease [of cereals: see preceding and next abstracts], misgivings regarding residues of zinc and lead compounds in the latter proving to be groundless. However, the high copper content of the grain in the untreated portions of the experimental area casts some doubt on copper deficiency as the exclusive cause of the disease and suggests the involvement of physiological factors in the therapeutic action of copper fertilizers.

RADEMACHER (B.). **Versuche über die Brauchbarkeit einer gemahlenen Kupferschlacke der Norddeutschen Affinerie-Hamburg als Kupferdünger.** [Experiments on the utility as a copper fertilizer of a ground copper slag of the North German Refinery, Hamburg.]—*Bodenk. u. PflErnähr.*, N.F., xx, pp. 247–256, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2306, 1941.]

In experiments at the Hohenheim Plant Protection Station copper slag, even in substantial amounts, failed to give adequate control of severe copper deficiency symptoms [as expressed in reclamation disease of cereals: see preceding abstracts], but proved useful both in mild cases of this disturbance and in prophylactic applications to ensure a reserve in the soil.

TEAKLE (L. J. H.), THOMAS (I.), & TURTON (A. G.). **Experiments with micro-elements for the growth of crops in Western Australia. I. Experiments in the Wheat belt with cereals.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 1, pp. 70–86, 1941.

During 1940, further experiments were carried out in the wheat belt of Western Australia to find new areas responding to micro-element fertilizers and to determine the value of other sources of copper than refined copper sulphate [*R.A.M.*, xix, p. 651]. The results showed that certain soil types in the Dandaragan district and a variety of the sandy and gravelly 'wodjil' soils were found to be acutely deficient in copper with respect to the growth of oats, wheat, and subterranean clover [*Trifolium subterraneum*], while other types appeared mildly deficient.

Certain wheat varieties, e.g., Bencubbin and Nabawa, on some copper-deficient soils, showed a purplish discoloration of the stalks and leaf sheaths. Wheat grown on copper-treated areas in copper-deficient soil had a more attractive appearance than that grown in the untreated soil. On soil acutely deficient in copper wheat sometimes failed to produce grain, and the empty heads stood erect, while in the case of oats the husks were pale and empty. Oats occasionally showed papery glumes. There was also a tendency to secondary tillers in late spring.

Some of the copper-deficient soils gave a better response when treated with impure copper fertilizers such as oxidized copper ore and roaster residues from pyrites burners than when treated with copper sulphate. This requires further investigation. On the dark grey calcareous soils near Dongarra the roaster residues gave about 30 per cent. improvement in crop, though copper ore was ineffective.

On certain types of 'wodjil' country copper applications produced striking results in the elimination of dummy heads. Growers are advised, before purchasing large quantities of copper sulphate, to carry out preliminary trials to ascertain whether their type of soil responds to the treatment; strips across the suspected soil types should be given a superphosphate-copper sulphate mixture supplying the latter ingredient at the rate of not more than 5 lb. per acre.

Determination of the copper content of oat leaves not later than six weeks after planting may indicate acute copper deficiency in the soil. Subterranean clover is even more useful for this purpose, substantial differences being observed between the copper content of leaves from control areas on acutely deficient land and adjacent treated areas.

GORDON (W. L.) & SPRAGUE (R.). **Species of *Fusarium* associated with root rots of the Gramineae in the Northern Great Plains.**—*Plant Dis. Repr.*, xxv, 7, pp. 168–180, 1941. [Mimeographed.]

The following species of *Fusarium* were collected during 1940 on cereals and grasses affected by root rot in the Northern Great Plains, United States, and isolated from the diseased parts after surface sterilization in calcium hypochlorite (48 gm. in 450 c.c. water) on potato dextrose or non-nutrient agar: *F. culmorum*, *F. equiseti*, *F. graminearum* [*Gibberella saubinetii*], *F. moniliforme* [*G. fujikuroi*], *F. oxysporum*, *F. poae*, *F. scirpi* and its vars. *acuminatum*, *compactum*, and *longipes*, *F. solani* and its var. *martii*, and *F. sporotrichoides*. Out of a total of 1,715 isolations, *F. equiseti*, *F. oxysporum*, and *F. scirpi* var. *acuminatum* accounted for 45.77, 43.73, and 6.36 per cent., respectively. *F. equiseti* predominated among the material collected in the early part of the season (12th May to 30th June), while *F. oxysporum* was more in evidence from 1st July to 15th August; *F. scirpi* var. *acuminatum* was more common than *F. oxysporum* in the collections made between 12th and 31st May but declined in prevalence later. None of these three species, which together constituted 95.86 per cent. of the total number of isolations, is generally recognized as a serious pathogen of Gramineae, whereas the definitely parasitic *G. saubinetii* and *F. culmorum* were seldom observed, comprising only 0.18 per cent. of the whole. The relative unimportance of species of *Fusarium* in comparison with *Helminthosporium sativum* in the etiology of the cereal and grass root rot complex in 1940 is thus readily explicable.

D'OLIVEIRA (B.). **Notas sobre a produção da fase aecídica de algumas ferrugens dos cereais em Portugal.** [Notes on the production of the aecidial stage of some cereal rusts in Portugal.]—*Rev. agron., Lisboa*, xxviii, 2, pp. 201–208, 1940. [English summary.]

Since 1934 the author has been engaged on the study of the aecidial phase of the principal cereal rusts (*Puccinia* spp.) in Portugal [*R.A.M.*, xx, p. 53], where teleutospore germination commonly occurs in the autumn and is not necessarily followed by a resting period prior to maturation in the cold weather, at any rate in the south of the country. The aecidia of *P. graminis* have not been found in Portugal, but those of *P. rubigo-vera tritici* (*P. triticea*) were observed as early as October near Lisbon on *Thalictrum flavum* subsp. *glaucum*. Only six of the 22 *T.* spp. inoculated with the wheat leaf rust proved to be immune, viz., *T. aquilegifolium*, *T. asplenifolium*, *T. dipterocarpum*, *T. hemense*, *T. palmatum*, and *T. simplex*, while particularly heavy infection occurred on *T. flavum*, *T. laserpitiiifolium*, *T. minus*, *T. petaloideum*, and *T. ruthenicum*.

P. rubigo-vera secalis (*P. dispersa*) [*P. secalina*] forms aecidia in the utmost profusion throughout the country on *Anchusa* spp. and *Echium tuberculatum* from the onset of the autumn rains to the end of the winter.

The aecidial stage of *P. anomala* has not been observed in nature in Portugal, but inoculation experiments on *Ornithogalum concinnum*, *O. dicergens*, *O. narbonense*, *O. umbellatum*, and *O. unifolium* resulted

in abundant infection, whereas *O. pyrenaicum* was immune and *O. arabicum* nearly so.

In the central and southern regions *Rhamnus alaternus* commonly shows heavy infection by the aecidia of *P. coronata arenae*, from which *R. frangula* and *R. oleoides* are immune.

The precocious development of the aecidial stage of the rusts under observation appears to constitute a very important source of infection for cereal crops in October and November, but from December onwards the partiality of snails and slugs for the pustules largely arrests the further production of aecidia.

BARTLETT (H.). **New Wheats for the North West.**—*Agric. Gaz. N.S.W.*, lii, 4, pp. 184–188, 4 figs., 1941.

A new wheat variety, Fedweb I, produced by W. L. Waterhouse from Federation and Webster for cultivation in the north-western area of New South Wales is stated to be resistant to all 7 races of stem rust [*Puccinia graminis*: *R.A.M.*, xviii, p. 239] found in Australia, including race 34. In tests in Queensland under conditions highly favourable to rust, small linear pustules developed on the stems, but satisfactory grain was produced. Fedweb shows moderate resistance to leaf rust [*P. triticea*], but is susceptible to flag smut [*Urocystis tritici*]. The Eureka variety [*ibid.*, xviii, p. 655] (a selection from the cross Kenya × Florence × Dundee) has the high resistance to stem rust of the Kenya parent, and since its release in 1938 has made rapid progress in areas where infection is prevalent. It is, however, highly susceptible to *Septoria* leaf spot [*S. tritici*]. Bordan is almost as resistant as Ford to stem rust and is superior in flag smut resistance.

NEWTON (MARGARET) & JOHNSON (T.). **Environmental reaction of physiologic races of *Puccinia triticea* and their distribution in Canada.**—*Canad. J. Res.*, Sect. C, xix, 4, pp. 121–133, 1941.

In experiments conducted in 1936 and 1939 at Winnipeg, it was found that the reactions of the differential varieties of wheat to physiologic races of *Puccinia triticea* [*R.A.M.*, xx, p. 54] are influenced by temperature and, in a lesser degree, by light. At lower temperatures (the experimental range being 57° to 75° F.) the varieties Malakoff, Norka, and Democrat became increasingly susceptible, and Carina, Brevit, and Hussar increasingly resistant, while Webster and Mediterranean were not consistent in either direction, and Loros was little influenced by temperature. All eight varieties showed a more or less marked tendency to become increasingly resistant under conditions of short day length and low light intensity.

Surveys of physiologic races of *P. triticea* in Canada carried out with some interruptions since 1931 have established the presence of 49 races, of which the predominant (2, 5, 9, 15, 31, 32, 34, 52, and 89) are distributed throughout the country. However, races 1, 58, 76, and 81 are largely confined to Eastern Canada (Ontario, Quebec, and the Maritime Provinces), except that in 1940 each of the three first-named races was collected once in the prairie region of Western Canada. Race 11 was collected 17 times from British Columbia, twice in Alberta, and once in the Maritime Provinces; race 53, seven times in British Colum-

bia, twice in Alberta, and twice in Manitoba. Races 5, 31, 44, and 52, found commonly in the prairie region, have never been collected in British Columbia. The fact that most races were collected year after year is taken as an indication that no radical change in respect of identity and relative prevalence has occurred in leaf rust during the past few years in Canada.

JOHNSTON (C. O.). **Some species of *Triticum* and related grasses as hosts for the leaf rust of Wheat, *Puccinia triticina* Erikss.**—*Trans. Kans. Acad. Sci.*, xliii, pp. 121-132, 1940.

Seedlings of one or more varieties of 19 species of *Triticum*, four of rye, 11 selections of wheat $\times$ rye hybrids, one sample of Michel's grass, a perennial believed to be the result of a cross between Mosida wheat (*T. vulgare*) and *Elymus condensatus*, one of *E. condensatus*, varieties of 18 species of *Aegilops*, and 15 species of *Agropyron* were tested with several physiologic races of *Puccinia triticina* [*R.A.M.*, xix, p. 139] in the greenhouse at the Kansas State College.

More selections resistant to races 5, 9, and 15 were found in 7- and 14-chromosome groups than in the 21 group. *T. timopheevi*, *T. dicoccum* var. Vernal, and *T. pyramidale* [var.] *copticum* were nearly immune from all three races, while *T. turgidum*, *T. monococcum* (einkorn), *T. durum* (Kubanka), and *T. aegilopoides* var. *pancici* were highly resistant. The four rye varieties, Abruzzi, Balbo, Kansas winter, and common spring, were immune or virtually so from infection by all three races, while ten of the eleven wheat $\times$ rye hybrids were susceptible. All the amphidiploid selections were susceptible. Michel's grass, which resembles rye in plant habit, was likewise highly resistant to the three races. *E. condensatus* was susceptible to 5 and 15, but the reactions of individual seedlings to race 9 were variable. Most of the *Aegilops* spp. were resistant to races 5, 9, 15, 28, and 37, but *A. ovata* [var.] *globulosa* and *A. sharonensis* were susceptible to all five, and *A. crassa* [var.] *rufescens* to all but race 5. Two lots of *A. cylindrica* exhibited strong differential reactions, characterized by susceptibility to races 9 and 37 and high resistance to 5, 15, and 28. Most of the 15 species of *Agropyron* tested were highly resistant to the five races of *P. triticina* used in the tests, though uredosori developed on six. *A. spicatum* was moderately susceptible to all the races except 9, while *A. subsecundum* was resistant to all but 37 and *A. inerme* to all but 9. Uredospores transferred from *A. desertorum*, *A. sibiricum*, *A. trichophorum*, *A. inerme*, *A. spicatum*, and *A. subsecundum* to Hybrid No. 128 wheat seedlings produced normal infection in each case. Two F_3 lines of *T. vulgare* $\times$ *A. elongatum* were nearly immune from all five races of the rust.

MIDDLETON (G. K.) & CHAPMAN (W. H.). **Resistance to floral-infecting loose smut (*Ustilago nuda*) in fall-sown Barley varieties at Statesville, North Carolina.**—*Phytopathology*, xxxi, 4, pp. 351-353, 1941.

The following average loose smut (*Ustilago nuda*) percentages were secured in ten barley varieties in a three-year (1937 to 1939) series of inoculation experiments by M. B. Moore's partial vacuum method [*R.A.M.*, xv, p. 567]: North Carolina Bearded 70, 45.0; Tennessee Hooded 36.5; N.C. Bearded 68, 34.6; N.C. Bearded 83, 20; Tennessee

Winter 10.0; N.C. Beardless 26. 6.7; and N.C. Beardless 23, N.C. Bearded 11 and 15, and Odessa, all 0. The best results were obtained when the inoculations were carried out from the second to the fifth day after the emergence of the heads from the 'boot', with the peak on the fourth. From inoculations on this day, 6 out of 9 heads of Tennessee Hooded and 7 out of 10 of N.C. Bearded 68 produced some diseased plants in the following season. Using Tapke's method of puncturing the glumes and inserting the inoculum with forceps in the spring of 1939, 7.9 and 1.2 per cent. infection developed in 1940 on Odessa and N.C. Bearded 15, respectively, but none on N.C. Beardless 23 and N.C. Bearded 11. Improved technique is therefore needed if fine distinctions are to be made between varieties.

HAYES (H. K.). **Barley varieties registered, VI.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 252-254, 1941.

Of the three barley varieties approved for registration in 1940, Barbless, Reg. No. 11, has given evidence of high resistance to stripe disease (*Helminthosporium gramineum*).

STANFORD (E. H.) & BRIGGS (F. N.). **Two additional factors for resistance to mildew in Barley.**—*J. agric. Res.*, lxi, 3, pp. 231-236, 1941.

Continuing their studies in California on the inheritance of resistance to mildew (*Erysiphe graminis hordei* race 3) in barley [*R.A.M.*, xviii, p. 515], the writers investigated the factors involved in this process in two additional resistant varieties, Psaknon and Duplex. The Psaknon (*Mlp*) factor found in Psaknon is dominant in effect and identical with one of the two factors previously reported in Arlington Awnless, Nigrate, and Chimerne; henceforth it will replace the *Mlr* factor designation provisionally assigned to these three varieties. A new factor found in Duplex combined with two previously identified factors, *Mlb* and *Mlp*, is recessive in effect and is designated the Duplex (*mld*) factor. In all, there are seven distinct factors for mildew resistance, one of which is recessive, the number in a single variety ranging from one to three. Two of the seven identified are definitely linked, while a third, the Duplex factor, may be linked with either the Hanna or the Psaknon. The single factor for resistance to race 6 of barley mildew found by Tidd (*Phytopathology*, xxx, 1, pp. 24-25, 1940) in a cross between the resistant Nepal 595 and the susceptible Featherstone must differ from any of those reported in the present series of experiments, since Nepal is completely susceptible to race 3.

GORTER (G. J. M. A.). **Stripe- or yellow-leaf disease of Oats.**—*Fmg S. Afr.*, xvi, 181, p. 140, 1941.

Early in the winter of 1940, oat plants received at Stellenbosch laboratory were found to be infected by *Helminthosporium avenae* [*R.A.M.*, xvii, p. 809], not previously recorded from the Union of South Africa, perhaps because farmers have overlooked it. The ascospore stage (*Pycnophora avenae*) [*ibid.*, xiv, p. 690] in the author's material occurred mainly in the vicinity of the nodes. Control is advised by seed disinfection, the ploughing-in of old stubble, and crop rotation.

STANTON (T. R.). **Registration of varieties and strains of Oats, X.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 246–251, 1941.

During 1940 the following six varieties of oats were approved for registration: Fultex, Reg. No. 92, resistant to smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) and crown rust [*Puccinia coronata*]; Vicland, Reg. No. 93, resistant to the races of smuts and rusts predominating in the north-central States; Ranger and Rustler, Reg. Nos. 94 and 95, resistant to the races of crown rust and smut prevalent in Texas; Huron, Reg. No. 96, highly resistant to smut; and Uton, Reg. No. 97, highly resistant to the Utah races of smuts.

TINGEY (D. C.), WOODWARD (R. W.), & STANTON (T. R.). **Uton: a new high-yielding white Oat resistant to loose and covered smuts.**—*Bull. Utah agric. Exp. Sta.* 296, 15 pp., 2 figs., 1941.

This is a detailed, tabulated account of the performance of Uton, the new variety of white oats derived from a cross between Markton and Swedish Select which has given such promising results in recent tests in Utah both in respect of productivity and resistance to loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*: see preceding abstract]).

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta.*, 1939–40, Part II, pp. 48–54, 1940.

In studies on maize diseases carried out in Iowa in 1939–40 [cf. *R.A.M.*, xix, p. 337] I. E. Melhus grew *Diplodia zeae* on media containing various carbon and nitrogen sources to determine their effect on growth. Determinations of the dry weight of mycelium resulting after spore inoculations indicated that the greatest growth occurred when asparagin was the nitrogen source, production on nitrate being next, and frequently not significantly different from that formed on ammonium salts. In a comparison of the carbon sources, with asparagin as a nitrogen source, the dry weight yield was greatest on starch, decreased in order with dextrose, maltose, dextrin, and was least with sucrose. In the case of all sources of carbon with asparagin as a nitrogen source the dry matter yield at 42 days was less than that at 21 days, this being true only with starch in the nitrate and ammonium series. The final P_H value of the different test materials appeared to depend on the nitrogen source. Attempts to eliminate micro-elements by absorption in charcoal gave conspicuously diminished yields at 21 days, but at 42 days the yield from the cultures without micro-elements was equal to that from those with them.

Comparative pathogenicity tests with *D. zeae* and other fungi isolated from maize roots in different parts of Iowa showed that the fungi concerned fell into three groups with respect to virulence, viz., (1) severe, *Pythium graminicola*, *Rhizoctonia* [*Corticium*] *solani*, (2) moderate, *D. zeae*, *Gibberella saubinetii*, *Helminthosporium sativum*, *P. de Baryanum*, (3) slight to none, *Trichoderma lignorum* [*T. viride*], *Aspergillus niger*, *Penicillium oralicum*, *Fusarium moniliforme* [*G. fujikuroi*], *Basidiosporium gallarum* [*Nigrospora* sp.], *Monotospora* sp. and *Fusarium* sp.

The succession of the pathogenic fungi on the roots and mesocotyls

of maize plants was followed in the laboratory and the field. As a rule, *Pythium de Baryanum* became parasitic before and after emergence, causing seed decay and stunting. Somewhat later, when the soil reached a higher temperature, *P. graminicola* appeared on the terminal portions of the roots, causing rapid necrosis.

C. S. Reddy found that susceptibility of yellow dent maize inbreds and hybrids to *Nigrospora* sp. is correlated with an immature condition of the ears when translocation ceases in autumn. Analysis of cob tissues from susceptible and resistant materials for sugars, protein, hemicellulose, lignin, and so forth, appeared to show only one constant difference, the presence of more sugar in susceptible than in resistant material. Equalization of sugar percentages between such materials did not, however, result in equally favourable growing conditions for *N. sp.* in culture. The material which appears to favour growth in susceptible tissues was found to be soluble in water and in 95 per cent. alcohol, to remain unabsorbed on charcoals, and to be undamaged, apparently, by autoclaving. A substance strongly inhibiting the growth of *N. sp.* was extracted from susceptible cob tissues gathered in late autumn. This substance was soluble in ether and in water.

In investigations by G. Semeniuk, I. E. Melhus, C. S. Reddy, W. E. Loomis, G. F. Sprague, and E. W. Lindstrom, 91 inbred lines and 23 single and double crosses of maize were tested in the field after pollination for their reaction to artificial inoculation with *D. zeae* and *G. saubinetii*. Highly significant differences in the spread of the fungi were shown on the inbred lines, but on the crosses there were slight or no significant differences. During the period under review the prevalence of natural stalk infection by *D. zeae* was greater than at any time since 1932. Highly significant differences were found in the susceptibility of different inbred lines and crosses to natural infection and stalk-rotting, but the mean infection of the crosses was as great as that of the inbred lines. In other tests by I. E. Melhus and R. Wilkinson more smut (*Ustilago zeae*) occurred in inbreds than in single crosses.

KERNKAMP (M. F.) & PETTY (M. A.). **Variation in the germination of chlamydospores of *Ustilago zeae*.**—*Phytopathology*, xxxi, 4, pp. 333-340, 2 figs., 1941.

In studies at the Minnesota Agriculture Experiment Station on the germination of chlamydospores derived from eight field collections, four crosses between monosporidial lines, and two monosporidial diploid lines of *Ustilago zeae* on potato dextrose agar, 25 germination types were observed [*R.A.M.*, xviii, p. 670; xix, p. 652], of which the production of the supposedly normal four-cell promycelium, with a sporidium on each cell, was not the most characteristic or prevalent. The following were the five most prevalent germination types and the number of crosses or collections in which each predominated: promycelia bearing one or more hyphal branches in place of sporidia (5); chlamydospores functioning as basal promycelial cells, thus forming sporidia directly on the spore (4); chlamydospores with two opposite promycelia (2); four-cell promycelia (2); and lysing promycelia (1).

Genetic factors appear to determine the tendency towards a given germination type.

KARPER (R. E.). **Registration of improved Sorghum varieties, II.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 257-258, 1941.

The two sorghum varieties approved for registration in 1940. Coes. Reg. No. 77. and Highland, Reg. No. 78. are both susceptible to smuts [*Sphacelotheca sorghi* and *S. cruenta*] but resistant to 'weak neck' [*R.A.M.*, xviii, p. 99].

WAGER (V. A.). **The November-drop and navel-end-rot problems of Navel Oranges.**—*Fmg S. Afr.*, xvi, 181, pp. 143-144, 4 figs., 1941.

This paper on November drop and basal end rot of Washington Navel oranges in South Africa, the latter condition being due to *Alternaria citri*, is a condensed version of two bulletins already noticed [*R.A.M.*, xix, pp. 401, 699].

DOIDGE (E[THEL] M.). **Scaly bark or psorosis of Citrus trees in South Africa.**—*Sci. Bull. Dep. Agric. S. Afr.* 208, 31 pp., 12 pl., 1939. [Received May, 1941.]

This is a useful summary of the position at the date of writing in regard to the knowledge of the etiology, mode of transmission, and control of citrus psorosis, with special reference to South African conditions [*R.A.M.*, xix, p. 86; xx, p. 200]. Most of the work referred to has already been noticed from other sources, but mention may be made of a superficial scaling of Natal Tight Skin tangerines inoculated with bark grafts from diseased trees which is apparently a form of psorosis. The condition, known as 'warmbaths disease', is characterized by the peeling-off of thin pieces of outer bark, $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter, followed by healing with a slight scar and the repetition of the process elsewhere. In a concluding section brief observations are made on some obscure bark disorders liable to confusion with psorosis, including one resembling leprosis [*ibid.*, xix, p. 85] and a curious type of bark scaling in which parallel cracks up to 9 in. long develop on the branches, converging upwards to meet in the shape of a spearhead. The outer cortex finally peels off, revealing longitudinal fissures down the centre of the lesions in the inner bark, exposing the wood. Callus is formed at the edges of the cracks and partial healing ensues, but an unsightly central scar is usually left. Considerable quantities of gum may be exuded from small branches in the incipient stages of cortical cracking. In one orchard the incidence of this trouble increased from 50 to nearly 100 per cent. in the space of a few months, and the death of some of the affected trees is expected. Valencia oranges on a waterlogged area of the Mazoe Estate, Southern Rhodesia, developed small, raised areas, exactly similar to those of psorosis, in the outer bark, corresponding to the emergence of firm, woody excrescences from the cambium. The lesions gradually expand and the bark peels off, with practically no extrusion of gum, which is present, however, in appreciable amounts in the wood a short distance below the cambium.

FAWCETT (H. S.). **Citrus viruses.**—*Phytopathology*, xxxi, 4, pp. 356–357, 1941.

The writer gives the definitions of the four citrus viruses for which the names of *Citrovir italicum*, *C. psorosis*, *C. psorosis* var. *vulgare*, and *C. psorosis* var. *annulatum* have already been proposed [*R.A.M.*, xx, p. 175]. It is possible that concave gum disease and blind pocket may also be caused by strains of the psorosis virus, in which case they would be classified as vars. *concavum* and *alveatum*, respectively [*ibid.*, xviii, p. 100].

GRIFFITH (E. B.). **Economic importance of Oak root fungus.**—*Calif. Citrogr.*, xxvi, 6, pp. 153, 180, 2 figs., 1941.

In this paper, read at a meeting of growers in California, the author states that *Armillaria mellea* [*R.A.M.*, xi, p. 40; xvii, p. 162] is becoming increasingly common every year in Californian orange groves. It is essential that control measures be instituted as soon as the disease is recognized. All diseased trees must be removed. The exact limits of the infected area must be determined by examining the roots and all vegetation in the area must then be killed by the application of a sufficient quantity of carbon disulphide. After about a month the treated area may be replanted with young trees. If slight infection recurs after two or three years, the limits of the infection must be found and the small area affected fumigated again. It can then be once more replanted, with little likelihood of the disease recurring.

SHTSHEPKINA (Mme T. V.). Описание эндопаразитов хлопковых волокон. [The description of endoparasites in Cotton fibres.]—*Bull. Acad. Sci. U.R.S.S.*, 1940, Sér. biol., 5, pp. 643–661, 6 figs., 1940. [English summary.]

The micro-organisms detected within cotton fibres by the colorimetric method described in a previous paper [*R.A.M.*, xvii, p. 173] were tentatively identified in pure culture as Hutchinson and Clayton's cytophaga, *Micropolispora cellulosisolvens*, *M. disjungens*, *Actinomyces penicilloides*, and *A. citromycelloides*, all of which are believed to be parasitic on cotton, being observed in fibre and seeds. *Proactinomyces catenulatus*, found developing within the cells of *Alternaria* in cotton fibres, is believed to be parasitic both on cotton and *Alternaria*.

DUNLAP (A. A.). **Inoculation of Cotton plants in sand culture with *Phymatotrichum* root rot.**—*Phytopathology*, xxxi, 4, pp. 358–361, 2 figs., 1941.

The following procedure gave satisfactory results in the inoculation of mature Rogers' Acala cotton plants with *Phymatotrichum omnivorum* in the greenhouse at the Texas Agricultural Experiment Station [*R.A.M.*, xx, p. 113]. A small mass of sterile Houston black clay soil was placed round the stem of the plant at the surface of the sand cultures, close to the stem, the surface sand being removed for this purpose. Inoculum in the form of one-month-old sclerotia was placed near the stem on this soil and another layer of soil was placed directly on top, making a small mound 6 to 8 cm. in depth, which was pressed firmly against both the plant stem and the sand. Within three weeks

of inoculation, 68 out of the 75 plants (91 per cent.) used in the test were reduced to a state of permanent wilting, while the remaining seven developed root lesions that would probably have resulted in eventual death. The first symptoms of wilting appeared in some of the plants as early as 8 to 10 days after inoculation, the process being completed in an average of 14.5 days.

BELTYUKOVA (Mme K. I.). **The antagonistic and stimulating effects of *B. mesentericus* on *Bact. malvacearum*, the agent of Cotton gummosis.**—*Mikrobiol. Zh.*, vii, 1-2, pp. 209-222, 1940. [Russian, with English summary.—Abs. in *Chem. Abstr.*, xxxv, 8, p. 2563, 1941.]

Bacillus mesentericus is stated to secrete a filter-passing, thermostable, specific substance which at low concentrations exerts a stimulatory action (synergy) on *Bacterium malvacearum*, the agent of cotton gummosis [blackarm]. In laboratory experiments the incidence of infection on the cotyledons of seedlings raised from seed treated with substantial amounts of the toxin was appreciably reduced, whereas small doses enhanced susceptibility to the disease.

THORBURN (ALICE M.) & VINCENT (J. M.). **Protection of cloth against microbial deterioration—methods of testing the value of antiseptics.**—*J. Aust. Inst. agric. Sci.*, vii, 1, pp. 29-31, 1941.

Simple tests are described for assessing the value of antiseptics in the protection of cotton fabrics under practical conditions. The authors' methods were to spray areas of cloth of known weight with enough solution to give amounts of antiseptic equivalent to a range of acid trichlorophenol on a cloth weight basis. All pieces of cloth in any one series received approximately equal volumes of solution applied to both sides. After treatment, the cloth was hung out to dry, wrapped, and stored in a dry cupboard until tested. Two simple methods for storage tests under humid conditions were devised. In one, pieces of cloth were exposed in small, dry, shallow dishes in larger Petri dishes containing free water, only one concentration being exposed within any closed vessel. In the other, cloth strips were immersed to about one-fifth of their height in water in unstoppered test tubes. In each case the cloth was examined for mould, and assessment made in comparison with controls.

Results obtained by this technique showed that considerably higher concentrations of the trichlorophenol and its sodium salt are required in the authors' test than when Hatfield's method [*R.A.M.*, xv, p. 69] is used; the free acid was less effective than the sodium salt, and with both there was steady loss of protective power with continued exposure, particularly with the free acid.

In tests of the ability of antiseptics to resist leaching by rain, pieces of treated and untreated material were cut to fit the bottom of 9 cm. Buchner funnels. A given head of distilled water was kept over the cloth for regular intervals, then allowed to run through it, and replaced by the next volume. To expedite the test and facilitate differentiation, the pieces of cloth were saturated with 1 per cent. sucrose before incubation. In this experiment, sodium salts of trichlorophenol and salicylanilide showed small resistance to leaching.

Resistance to evaporation was tested by exposing sprayed cloth to a fan for seven days, and comparing subsequent protection in a humid atmosphere with that of cloth similarly sprayed but kept in a closed container, both series being heavily inoculated with *Aspergillus niger* spores. The cloth exposed to the fan, whether treated with the acid or the sodium salt, showed heavy growth at from 0.5 to 1 per cent., whereas in both treatments the cloth kept in containers during storage gave full protection as low as 0.5 per cent.

Hatfield determined the 'killing' concentration by removing inoculum blocks which had been in contact with the antiseptic-treated agar on to fresh slopes of malt agar, and regarded growth failure in the transplant as evidence of death at that concentration. The authors point out that such prevention of growth might be due to persistent inhibition by reason of substance carried over in the inoculum block diffusing into the fresh medium. In their own experience, 0.01 per cent. trichlorophenol inhibited growth, and the inoculum when removed to a fresh slope failed to grow, but fresh spores also failed to grow on this slope. The same inoculum, when removed, soaked in sterile water, and then placed on a fresh slope grew abundantly. A true killing effect was, however, demonstrated with higher concentrations.

HEGARTY (F. A.) & WEIDMAN (F. D.). **Symposium on fungous infections. Clinical aspects of fungous infections. The laboratory aspects of fungous infections.**—*Penn. med. J.*, xlv, 7, pp. 847–855, 1941.

F. A. Hegarty's contribution to the present series of studies on fungal diseases of man consists of descriptions of the clinical manifestations of some well-known types of ringworm, favus, moniliasis, tinea, onychomycosis, blastomycosis, and sporotrichosis, while F. D. Weidman gives particulars of laboratory methods for use in the collection, microscopic examination, staining, and cultural identification of the causal organisms.

WADE (L. J.) & STEVENSON (L. D.). **Torula infection.**—*Yale J. Biol. Med.*, xiii, 4, pp. 467–476, 4 figs., 1941.

Full clinical details are given of a case of meningo-encephalitis in a 39-year-old German-born woman in New York, from whose cerebrospinal fluid *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xx, p. 202, and next abstracts] was isolated in the course of a post-mortem examination and shown by inoculation experiments to be pathogenic to mice, giving positive results (mostly involving the lungs) in 36 out of 40 cases.

BINFORD (C. H.). **Torulosis of the central nervous system. Review of recent literature and report of a case.**—*Amer. J. clin. Path.*, xi, 3, pp. 242–251, 3 figs., 1941.

Following a review of recent literature on torulosis of the central nervous system, accompanied by a table presenting the salient features of 14 cases, the writer describes a non-fatal case of the disease in a 41-year-old male treated at the United States Maine Hospital, Detroit, Michigan, in 1939. *Torula histolytica* [*Debaryomyces neoformans*: see preceding and next abstracts] was isolated on blood agar from nodules

in the groin of a guinea-pig inoculated with the patient's cerebrospinal fluid and injected into mice and other guinea-pigs with positive results.

STILES (W. W.) & CURTISS (A. N.). **Torula meningoencephalitis. Report of a case : observation of the cerebrospinal fluid.**—*J. Amer. med. Ass.*, cxvi, 15, pp. 1633–1635, 1 graph, 1941.

Full clinical details are given of a fatal case of meningo-encephalitis in a 63-year-old male admitted to the Syracuse (New York) Memorial Hospital in 1938. *Torula histolytica* [*Debaryomyces neoformans*: see preceding abstracts] was isolated on plain, rabbit's blood, and Sabouraud's agars at 37° C. from samples of the spinal fluid and experimentally shown to be pathogenic to mice and in one instance also to a rabbit, the fungus being recovered from the invaded tissues.

HOWELL (A.). **Studies on *Histoplasma capsulatum* and similar form-species. III. Effect of hydrogen ion concentration.**—*Mycologia*, xxxiii, 1, pp. 103–117, 3 figs., 2 graphs, 1941.

In further studies of this series [*R.A.M.*, xx, p. 61] it was found that on the synthetic media used, the optimum H-ion concentration for the growth and sporulation of *Histoplasma capsulatum* was approximately P_H 6.5 to 7.5 and for *Sepedonium chrysospermum* P_H 6.5 to 7. When the carbohydrate-amino acid balance in the colonies was changed, corresponding changes also occurred in the acidity of the substratum. Thus, when the ratio of carbohydrates to amino acids was 15 to 1.8 the medium remained relatively constant, while with a ratio of 16 to 0.24, the medium became definitely more acid.

ORMSBY (O. S.). **Mycotic infections of the skin.**—*New Engl. J. Med.*, ccxxiv, 16, pp. 673–678, 1941.

This is a review of current development in the study of ringworms of the hands and feet (*Epidermophyton* and *Trichophyton* spp.), which are stated to have been practically unknown in the United States until 1916, and yeast dermatoses (moniliasis), most commonly associated with *Monilia* [*Candida*] *albicans*. The clinical features, diagnosis, etiology, and therapy of the various disorders under investigation are clearly described.

FOWLER (E. P. F.). **The bacteriology of acute otitis media and its course under new and old methods of treatment.**—*Canad. med. Ass. J.*, xlv, 4, pp. 372–380, 3 graphs, 1941.

Aspergillus niger was isolated from the aural canal in only four cases (0.05 per cent.) of otitis media in an extensive series of routine cultures in the author's hospital practice in New York [*R.A.M.*, xx, p. 260].

VAN BREE (R. S.). **Moniliasis. Sulfapyridine treatment.**—*J. Mich. med. Soc.*, xl, 3, pp. 197–199, 4 figs., 1941.

A clinical description is given of a long-standing case of gastrointestinal and pulmonary moniliasis in a 49-year-old male at Grand Rapids, Michigan, to which special interest is considered to attach in view of the scarcity of reports in the literature in which the etiology

of the disease has been clearly demonstrated. In the present instance, a species of *Monilia* [? *Candida*] was isolated from the throat, bile, faeces, and sputum, the injection of a pure culture of which into a rabbit caused death, the histological symptoms being consistent with those of fungal invasion. The patient's symptoms responded favourably to sulphapyridin therapy.

ZEROVA (Mme M. Y.). Хвороби Лілій в київських квітівництвах. [Diseases of Lilies in Kieff nurseries.]—*J. Bot. Acad. Sci. Ukr.*, i, 1, pp. 143–147, 7 figs., 1940. [English summary.]

Observations of recent years in Kieff (Ukraine) nurseries showed that bulb rot caused by *Fusarium redolens* and leaf spot due to *Cercospora inconspicua* [R.A.M., iv, p. 672] are the two most important and widespread diseases of lilies. Less destructive are brown leaf spot (*Botrytis elliptica*) [ibid., xviii, p. 443] and the grey rot of buds and flowers (*B. cinerea*) [ibid., xiii, p. 704] observed in summer during periods of prolonged warm and moist weather or after continual rain. Of the lily species cultivated at Kieff, *Lilium candidum* proved to be the most susceptible to all diseases, while *L. harrisii* and *L. regale* suffered more severely from *C. inconspicua* than from *F. redolens*; the two *Botrytis* diseases were found on all varieties of lilies, but were not widely distributed. Plants attacked by *F. redolens* and *C. inconspicua* sometimes died off on entire sections of the nursery as early in the season as before or during flowering. High temperature and moisture content of the soil are essential for the development and spread of *F. redolens*. Good control of the disease resulted from drying slightly infected bulbs at about 38° C. for three to four weeks before storing; severely infected bulbs should be destroyed. *C. inconspicua* infection, which appeared in some years at the very beginning of the vegetative period and lasted till the autumn, is a limiting factor in lily cultivation. The disease retards the growth and flower development of the plant and spoils their appearance through spotting. The development of this disease is somewhat arrested by an early application of Bordeaux mixture.

DODGE (B. O.) & LASKARIS (T.). *Botrytis* core-rot of *Gladiolus*.—*J.N.Y. bot. Gdn*, xlii, 496 (Sect. 1), pp. 92–95, 5 figs., 1941.

The spores of the *Botrytis* isolated in pure culture from gladiolus corms affected by core rot on Long Island, New York, measured 12.5 to 21.4 by 8.3 to 13.2 (average 15.8 by 10.5) μ and thus agree closely with those given by W. C. Moore in his manual of bulb diseases [R.A.M., xix, p. 153] for (?) *B. gladioli* [ibid., x, p. 274]. *Penicillium gladioli* [ibid., xv, p. 468] is commonly found in association with the *Botrytis* in diseased corms and is liable to develop with the latter in cultures from large pieces of tissue. F. L. Drayton (*in litt.*) has informed the writers that the core rot occurs in a destructive form in Canada, a grower near Toronto having recently reported the loss from this cause of 250,000 corms out of a stock of 3,000,000. Control measures should be based on stringent field and storehouse sanitation, special care being taken to dry any corms dug during wet weather, a practice to be avoided whenever possible.

BRIERLEY (P.) & SMITH (F. F.). **Mosaic and streak diseases of Rose.**—*J. agric. Res.*, lxi, 9, pp. 625–660, 10 figs., 1940.

In this paper a full account is given of a detailed study made in the United States from 1932 to 1938 of rose mosaic and its control, in the course of which investigations were also made into a form of streak [*R.A.M.*, xiv, p. 363]. The results obtained may be summarized as follows:

In the Mme Butterfly variety the symptoms of rose mosaic are prominent chlorotic areas feathering away from the midribs of leaflets, and also ring, oak-leaf, and watermark patterns. The yellow types of rose mosaic (which are similar to rose mosaics 2 and 3 of Thomas and Massey [*ibid.*, xix, p. 409]) are characterized by brighter and lighter yellow patterns than are found in typical rose mosaic (Thomas and Massey's rose mosaic 1). Diagnostic symptoms of streak include brown rings, brown or yellow veinbanding, and senescence patterns in leaves, and brownish or greenish ring markings in canes. Some hybrid tea roses show necrotic primary lesions in the canes. Numerous chlorotic speckle and crinkle patterns, including the disorder of Manetti roses known as 'rattlesnake' in the Pacific Northwest are not related to rose mosaic. Field diagnosis of rose mosaic and streak is unreliable, because of the tendency of the symptoms to become masked in some varieties.

The occurrence of rose mosaic was confirmed by its transfer to healthy Mme Butterfly from 17 rose varieties from seven States and the Province of Ontario, but the disease was found to be prevalent only in association with certain propagation practices. Yellow mosaics were observed in scattered single plants in four localities. Streak occurs in Maryland, New York, Texas, Virginia, and District of Columbia, and affected 30 per cent. of the roses in one collection of varieties.

All three diseases were transmitted experimentally only by budding or grafting, and transmission did not take place when the buds were removed before union occurred. The minimum incubation periods for all three were about 20 days, though in some cases incubation required several months. No seed transmission of mosaic or streak was apparent in small populations of seedlings from affected plants. Attempts at insect transmission, using 31 species of insect for mosaic and 34 species for streak, gave negative results.

All rose varieties tested were susceptible to mosaic and yellow mosaic, but showed different degrees of tolerance. Rose varieties and species can be arranged in three groups in respect to streak reaction, viz.: (1) susceptible to systemic infection, (2) subject to primary necrotic lesions in the canes, and (3) resistant. No natural spread of mosaic or streak was observed in field trials in four States, the evidence indicating that spread in nature is probably due to the nursery practice of propagating roses on rooted cuttings taken from the tops of budded understocks of the previous season. The suggestion is put forward that mosaic, and probably the yellow mosaics and streak also, may be controlled by the use of understocks from a mother block indexed to assure freedom from these conditions.

It is believed that streak is unrelated to the mosaics and unlike the necrotic diseases of rose described by Grieve from Australia [*ibid.*, x, p. 733] and Gigante from Italy [*ibid.*, xvi, p. 179].

ROSEN (H. R.). **Breeding a disease-resistant red climbing Rose.**—*Science*, N.S., xciii, 2411, pp. 259–260, 1941.

Details are given of the characters and performance of a red climbing rose, Stephen Foster, developed at the Arkansas Agricultural Experiment Station from a cross between a pink-blossomed climber (probably a hybrid of *Rosa setigera*) and the red Hybrid Tea variety Black Knight. It is resistant to powdery mildew [*Sphaerotheca pannosa*] under local conditions, though not immune from the pathogen in inoculation tests, and capable of withstanding very low winter temperatures, both serious sources of trouble among climbing roses in widespread areas of the United States.

LOOS (C. A.). **Some diseases of garden plants.**—*Trop. Agriculturist*, xcvi, 1, pp. 22–27, 2 pl., 1941.

Chrysanthemum plants in Ceylon were observed to show a condition in which the lower leaves were dead and hung down alongside the stem. Brown spots ranging from small dots to large blotches were present on the upper leaves, and the flowers and flower buds withered prematurely. *Septoria obesa* [R.A.M., vii, p. 244] was present on every affected plant examined. The pycnidia measured 86 to 173 μ in diameter and the spores were thick and rounded near the base, tapered towards the apex, up to 9-septate, and measured 66 to 87 by 3.2 to 3.6 μ . It is thought that spread would be checked by removing the diseased leaves and spraying the plants at frequent intervals with a fungicide.

MARCHIONATTO (J. B.). **Las enfermedades de las Dalias.** [Dahlia diseases.]—*Bol. agric., Mendoza*, viii, 10–12, pp. 337–341, 5 figs., 1940.

Popular notes are given on the occurrence and control in the Argentine of the dahlia diseases caused by *Entyloma dahliae* [R.A.M., xviii, p. 478], *Botrytis cinerea* [ibid., xviii, p. 295], *Sclerotium rolfsii* [ibid., xiii, p. 327], mosaic, and ring spot or tomato spotted wilt [ibid., xix, pp. 255, 568, *et passim*], transmissible by *Thrips tabaci* and constituting the most serious obstacle to the cultivation of the plant in the localities involved.

HERBERT (D. A.). **Puccinia distincta McAlp. as the cause of English Marigold rust.**—*J. Aust. Inst. agric. Sci.*, vii, 1, pp. 27–28, 1941.

In this paper the author presents evidence from field observations and experiments supporting the view that *Puccinia calendulae* McAlp. [1903], causing rust of the English marigold (*Calendula officinalis*), is identical with *P. distincta* McAlp. [1895] from the English daisy (*Bellis perennis*) and with *P. cinerariae* McAlp. from the garden cineraria (*Senecio cruentus*). Examination of Queensland material confirmed Cunningham's observations in New Zealand that *P. cinerariae* McAlp. (1906) and *P. allanii* G. H. Cunn. (1923: from the New Zealand endemic *S. lagopus*) are identical, and also showed *P. calendulae* to be morphologically indistinguishable from them. Experiments showed that *P. calendulae* from marigold readily infects *B. perennis* and cineraria with apparent difficulty. *P. cinerariae* from cineraria infects the marigold and *B. perennis* readily and the cineraria (a host not commonly attacked) with apparent difficulty. *P. distincta* from *B. perennis* infects

marigold readily. The synonymy of *P. distincta* includes *Aecidium calendulae* McAlp. (1896), in addition to the species mentioned above. The fungus is found only in Australia and New Zealand.

ZEROVA (Mme M. Y.). Захворювання Кактусових, спричинені грибами *Gloeosporium amoenum* Sacc., *Macrophoma opuntiae phaeacanthae* sp. nov., *Botrytis cinerea* Pers. [Diseases of Cactus, caused by the fungi *Gloeosporium amoenum* Sacc., *Macrophoma opuntiae phaeacanthae* sp. nov., and *Botrytis cinerea* Pers.] *J. Bot. Acad. Sci. Ukr.*, i, 2, pp. 301–303, 5 figs., 1940. [English summary.]

The following diseases of *Opuntia phaeacantha* were observed in Kieff (Ukrainian S.S.R.). Anthracnose, caused by *Gloeosporium amoenum*, attacked a great number of plants in the open in the acclimatization plots of the Institute of Botany, causing grey lesions with a yellowish-brown margin on the stems of the plant. The disease usually appeared late in the spring, but with the advent of hot summer days some plants were observed to recover and to develop new stems, while the affected tissue dried up and sometimes fell out. Artificial infection of another species of *Opuntia* [unspecified] with this fungus gave positive results. A disease observed in the greenhouse, characterized by a blackening and wilting of diseased stems, proved to be due to *Macrophoma opuntiae phaeacanthae* n.sp. described [in Ukrainian and Latin] as having immersed, black, globose, thick-walled pycnidia, 384 to 464 μ in diameter, with a short, cylindrical, broad ostiole; short, cylindrical, hyaline conidiophores, 13 to 16 by 2 μ ; and oval, unicellular spores, 23 to 39.1 by 11.5 to 15 μ . *Botrytis cinerea* was also found in the greenhouse causing a stem rot.

HARRINGTON (G. E.). **Thiuram sulfide for turf diseases.**—*Science*, N.S., xciii, 2413, p. 311, 1941.

In tests carried out at the Arlington Experiment Farm, Virginia, and on two golf courses in the vicinity, tetramethyl thiuramdisulphide was applied to three strains of creeping bent grass [*Agrostis stolonifera*] for the control of brown patch (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, xvii, p. 186] and dollar spot (*Sclerotinia homoeocarpa*) [*ibid.*, xvi, p. 681]. The chemical, mixed with dry sand, was scattered evenly over the area treated and watered in lightly. Treatments were made at weekly intervals, in summer against *C. solani* and in spring and autumn against *S. homoeocarpa*. Both diseases were completely controlled by applications made at the rate of 4 oz. per 1,000 sq. ft. of turf, although the untreated plots showed 70 per cent. infection. The treated turf was also superior in quality to that in other plots to which mercury preparations had been applied. Applications at half-rate were as effective as those at the full rate against *S. homoeocarpa*, but others at quarter-rate gave 7 to 15 per cent. infection.

MYERS (W. M.) & CHILTON (S. J. P.). **Correlated studies of winter-hardiness and rust reaction of parents and inbred progenies of Orchard Grass and Timothy.**—*J. Amer. Soc. Agron.*, xxxiii, 3, pp. 215–220, 2 figs., 1941.

At the United States Regional Pasture Research Laboratory, State

College, Pennsylvania, statistically significant differences in winter injury were observed between 59 parental clones of orchard grass [*Dactylis glomerata*] and 60 of timothy [*Phleum pratense*] during the severe winter of 1939 to 1940, which was preceded by epidemics of *Puccinia graminis* in the former crop and of *P. phlei-pratensis* [R.A.M., ix, p. 459] in the latter. Severity of rust was found to be correlated with the degree of winter injury in the parental clones of timothy, but no corresponding association was observed in the case of orchard grass.

BEAR (E. M.). **Insecticides and fungicides. Parts I and II.**—*Fruit-grower*, xci, 2363, pp. 275–276; 2364, pp. 295–296, 1941.

Useful, practical directions are given for the treatment of fruit trees and bushes with some standard fungicides against a number of common diseases. Standard Bordeaux mixture (8–8–100) frequently involving too much risk of injury to the trees, a formula of 6–9–100 is now recommended for use on Morello cherries, pears, and apples.

DIPPENAAR (B. J.). **Diseases of fruit trees caused by leaf-rust, manganese and zinc deficiencies, and their joint control.**—*S. Afr. J. Sci.*, xxxvii, pp. 136–155, 7 figs., 1941.

The three diseases primarily responsible for the prevalent decline of stone fruit trees in the western Cape Province of recent years are stated to be leaf rust (*Puccinia pruni-spinosae*) [R.A.M., xvi, p. 638], little leaf [ibid., xviii, p. 187], and mottle leaf, the last two associated, respectively, with zinc and manganese deficiency. Mottle leaf was first experimentally identified during the growing season of 1939 to 1940, and shown to be fairly widespread in the Stellenbosch and neighbouring districts. A suspected deficiency of manganese may be identified by the simple expedient of dipping leaves of twigs of actively growing trees in solutions of manganese sulphate (0.25 or 1 per cent.) or the same (1 per cent.) plus 1 per cent. hydrated lime [ibid., xvii, p. 751]. Peach and apricot shoots recover within a fortnight of immersion, while citrus requires a somewhat longer period, the last-named also responding favourably to a mixture of 0.25 per cent. potassium permanganate and 1 per cent. of lime. An even simpler method consists in placing a number of droplets of any of the above-mentioned solutions on the chlorotic areas of the leaves, which will react by the development of the normal green tint against a yellow background. Evidence of manganese deficiency, expressed in the form of mottle leaf, was secured by the means described in Santa Rosa, Kelsey, and Sultan plums, Victoria, Early Rivers, and Gold Mine nectarines, Elberta and Muir peaches, Royal and Cape apricots, Cape lemons, chestnuts, apples, vines, and figs. Among the ornamentals benefiting by manganese applications may be mentioned rose, granadilla (*Passiflora quintensis*), sunflower, and *Bougainvillea*. French beans (*Phaseolus vulgaris*) and potatoes are the only vegetables in which manganese deficiency has been positively demonstrated. The chlorosis which is the principal external symptom of an inadequate manganese supply may be of varying intensity, from a mere trace of pallor in the normal green colour between the lateral veins on either side of the midrib to the involvement of almost the entire leaf surface except for strips of green along the midrib and on

either side of it, as well as on each side of the lateral veins. In cases of intermediate severity the green colour is also retained along the cross veins between the lateral ones, forming chlorotic islands. Marginal scorch, or necrosis of the chlorotic areas, may occur under extremely hot and dry conditions on chestnut, bean, and potato foliage. The only sign of manganese deficiency on fruits so far observed is a severe cracking of Santa Rosa plums, which was effectively combated by the insertion into the stems, five weeks before the onset of maturity, of crystals of manganese sulphate and potassium permanganate, the incidence of the trouble being reduced from between 50 and 60 per cent. on the controls to under 1 per cent.

Little leaf, of equally wide distribution with mottle leaf, is far more destructive, affecting pears and grapefruit in addition to the fruits mentioned above. The disease falls into three phases, of which the first is mottling and chlorosis of the leaves (accompanied in apple and peach by the formation of a purplish pigment in and along the network of cross veins), the second is characterized by extreme reduction in the size of the leaves, especially those originating from the terminal buds of the leaders, while the third is a die-back of the leaders affected in previous seasons. The removal of the dead wood by pruning reduced the diseased trees to inconsiderable proportions within four or five years. *Schizophyllum commune* and other wound parasites accelerate the end of trees brought into a state of debility by little leaf.

P. pruni-spinosae, always troublesome on d'Agen prunes, almonds, peaches, and Japanese plums [*Prunus salicina*], has lately caused concern among Wellington growers on account of its attacks on Alpha apricots. Not only do the cumulative effects of rust contribute to the gradual decline of orchard productivity through repeated premature defoliation, but direct infection of the fruit, in the shape of blemishes and cracks, renders it unfit for export and canning.

Little leaf of peaches was experimentally shown to yield much more readily to a late spring treatment with zinc-lime (10-5-100) than to dormant sprays of zinc sulphate only. Plums, on the other hand, derived more benefit from a dormant application of zinc sulphate (50-100). Complete control of mottle leaf in Victoria nectarines, plums, and citrus was obtained by the application in January and February, 1940, of the above-mentioned manganese-containing compounds. Zinc-lime sprays (10-5-100) were equally effective with Bordeaux mixture (4-4-100) against *P. pruni-spinosae*, a mixture of potassium permanganate and lime giving slightly less favourable results.

MAIER (W.). **Stippigkeit und Bormangelkrankheiten bei Äpfeln.** [Bitter pit and boron deficiency diseases among Apples.]—*Gartenbauwiss.*, xv, pp. 427-452, 1941. [Abs. in *Chem. Zbl.*, cxii (i), 17, p. 2305, 1941.]

Statements in the relevant literature regarding the possibility of combating bitter pit of apples by the application of borax or boric acid fertilizers are thought to be attributable partly to inaccurate methods of experimentation, and partly to confusion between bitter pit and a boron deficiency disease, internal cork [*R.A.M.*, xix, p. 604], the

presence of which in Germany, where it was hitherto unknown, is here recorded for the first time.

KEITT (G. W.), CLAYTON (C. N.), & LANGFORD (M. H.). **Experiments with eradicant fungicides for combating Apple scab.** — *Phytopathology*, xxxi, 4, pp. 296–322, 1 diag., 5 graphs, 1941.

In 1936, 1937, and 1938, a small orchard of Wealthy apple trees in Wisconsin was sprayed after harvest and before leaf fall with a mixture consisting of 8 lb. copper sulphate, 2 lb. monocalcium arsenite, 6 lb. zinc arsenite, 3 qt. fish oil, and water to make up to 100 gals. with the object of limiting scab (*Venturia inaequalis*) ascospore production. No summer spray was given. Counts indicated a reduction due to the treatment of 97 to 100 per cent. in the numbers of fertile perithecia of the fungus in the overwintered foliage and a closely corresponding diminution of ascospore infection as compared with the figures obtained in a neighbouring unsprayed orchard. At harvest time in 1937, 1938, and 1939 the treatment was found to have reduced the number of lesions by 96, 91, and 98 per cent., respectively. Wealthy trees sustained no injury from the fungicide, which caused some damage, however, to both lateral and terminal buds of Northwestern Greening and McIntosh.

In 1939 the overwintered leaves on the ground in a six-acre McIntosh orchard in sod were sprayed with elgetol extra [*R.A.M.*, xx, p. 212], 1 per cent. by volume in water, at the rate of 450 gals. per acre, which was found to reduce the ascospore infection by about 96 per cent. Three weeks after petal-fall the scab epidemic on unsprayed trees in the treated orchard was reduced by about nine-tenths as compared with the condition of one left untreated a short distance away, thereby greatly enhancing the efficacy of the summer spray schedules adopted.

The results of these experiments establish for apple scab the principles (a) that the amount of primary inoculum is a major factor in determining the time and intensity of epidemic development, and (b) that these in their turn exert a decisive influence on the requirements for its control.

BODINE (E. W.) & DURRELL (L. W.). **Host range of Peach-mosaic virus in western Colorado.** — *Phytopathology*, xxxi, 4, pp. 322–333, 3 figs., 1941.

Trees of an unknown almond variety, Montgamet and Smith apricots, Royal Duke cherry, Hungarian prune, and Green Gage. Satsuma, Maynard, Blue Damson, and Wickson plums were inoculated by budding with the peach mosaic virus [*R.A.M.*, xviii, p. 260]. Of these, only the Hungarian prune and Montgamet apricot showed external symptoms of infection, which was proved, however, by means of bud insertions into healthy Elberta peach trees and seedlings, to have been contracted by all the trees inoculated. Grafting a total of 1,340 plum (25 varieties), apricot (three varieties), and almond (one variety) with two healthy Elberta peach scions per tree revealed no case of peach mosaic infection.

Spontaneous mosaic infection has been observed on Montgamet and an unknown variety of apricot, Royal Duke cherry, flowering peach,

Satsuma plum, and Italian prune. In order to ascertain whether these disorders were the outcome of infection by peach mosaic, buds from trees of each affected variety were inserted into healthy Elberta peach trees and seedlings, of which, however, only those inoculated with flowering peach buds developed peach mosaic symptoms. The unknown apricot and Satsuma plum introduced into the peach hosts a distinct mosaic communicable from apricot to plum and vice versa and apparently due to an identical virus. By bud inoculations of the same variety from which the buds were obtained, the virus natures of all the spontaneously occurring mosaics investigated, except those of Italian prune and Montgamet apricot, were demonstrated.

A five-year (1935 to 1939) study of the incidence of peach mosaic in seven orchards showed that the eradication of diseased trees definitely arrested the spread of mosaic in three orchards planted only with the Elberta or J. H. Hale variety or both, whereas in the remaining four occupied by a mixture of several other varieties besides those two, continuous roguing failed to check the progress of the disease.

Grafting Elberta test scions on 200 peach trees of the Carman, Guinn, Salwey, Wonderful, and Victor varieties, selected at random, gave variable results. In many cases where no mosaic symptoms were apparent in the stocks, slight to moderate infection developed in the scions, while in others of slight infection in the stocks, moderate to severe symptoms occurred in the scions. Again, scions growing on mildly affected stocks showed no symptoms, and finally, there were many cases in which mosaic was absent both from stock and scion.

HILDEBRAND (E. M.). A new case of rosette mosaic on Peach.—*Phytopathology*, xxxi, 4, pp. 353–355, 2 figs., 1941.

In 1938 a peach tree was observed in Rockland County, New York, to be suffering from a disorder not hitherto observed in the State and apparently identical with Cation's Michigan rosette or rosette mosaic (*Quart. Bull. Mich. agric. Exp. Sta.*, xvi, pp. 79–84, 1933) [cf. *R.A.M.*, xiv, p. 219]. Ten Elberta trees in the greenhouse inoculated with the disease by budding during the late summer developed foliar distortion and chlorosis in the following February, similar symptoms being obtained in infection tests with Michigan budwood. The mosaic symptoms gradually disappeared as the season advanced, but the peculiar wavy habit of growth and rosetting of the foliage and stunting of the trees persisted. Some of the infected trees produced ripe, well flavoured, naphthalene-yellow fruit during the first week of May. The writer (unpublished data) has induced a similar but milder wavy-leaf condition in Elberta peach trees by budding with material from mosaic-diseased prunes [see preceding abstract], suggesting the possibility of a relationship between the prune mosaic and peach rosette mosaic viruses.

KILPATRICK (D. T.). Manganese deficiency in Peaches. *Agric. Gaz. N.S.W.*, lii, 3, pp. 151–152, 1 fig., 1941.

Blackburn peaches growing on a shale type of soil at Wedderburn, New South Wales, have shown symptoms of manganese deficiency, consisting of an intravenous leaf chlorosis, the midrib and veins and the adjoining parts being deep green, while the rest of the leaf is a

lighter, dull hue. The most severely affected leaves are small, and are generally borne on spur extensions and at the bases of laterals. Seen as a whole, the foliage of a badly affected tree is yellowish, while that of a slightly affected tree has a dull, mottled appearance. The condition, which appears to be a limiting factor in both growth and fruit production, was corrected by a winter spray (early July) made at the rate of 1 lb. manganese sulphate per 2 gals. of water.

SERBINOFF (V. I.). Пятнистость Абрикосов и борьба с этим заболеванием. [Spotting of Apricots and its control.] -60 pp., 7 figs., 2 diagrs., Госуд. Издат. Таджикирк. ССР. [State Publ. Off. Tadzhik S.S.R.], Stalinabad Leningrad, 1940.

In studies conducted at the Scientific Research Institute for fruit, vine, and vegetable cultivation in the Tadzhik S.S.R. [Russian Central Asia] from 1935 to 1938, it was found that spotting of apricots often occurs in the absence of *Clasterosporium carpophilum* [R.A.M., viii, p. 319], generally believed to be the causal agent of this disease. Inoculations with cultures of the fungus in the laboratory and field failed to cause infection of apricot fruits, and the few spots produced on the leaves did not resemble those found in nature. Isolates from diseased apricot tissues yielded a bacterium similar to *Bacterium pruni*, and the pathogenicity of this organism was proved in both greenhouse and orchard inoculations, the symptoms produced being identical with those observed on naturally infected trees. It is concluded that the spotting is caused chiefly by this bacterium, though *C. carpophilum* may play some part as well. The disease is stated to attack mainly the fruits under Tadzhik conditions, leaves and stems being affected to a lesser degree. Infection is spread by rain, branches protected by waxed bags showing only 29.4 per cent. fruits, compared with 79.1 per cent. for those protected only by gauze and 92.5 per cent. for the unprotected. It is believed that the inoculum accumulates during the winter in gumming wounds and that in spring the rains dissolve the gum and wash it on to the lower shoots, leaves, and fruits. Observations over many years show that infection occurs five to six days after the first rain following blossoming, but a period with an air humidity of not less than 70 per cent. is essential for infection to take place. Proper care of the orchards and timely removal of dead branches, tend to reduce infection. In tests in 1935 the varieties Mirsandzheli, Khournai, and Khassak showed on the average 97, 94, and 91 per cent. spotted fruits, respectively, the corresponding figures in 1937 being 81, 54, and 28 per cent. Of these varieties the first-named is the sweetest, and according to results obtained by other workers the sweeter varieties are the more susceptible [loc. cit.].

In Russian Central Asia, and in particular in the Tadzhik S.S.R., widespread infection of apricot trees occurs every year. Data obtained from typical orchards showed that the spotting caused a reduction of 27.57 per cent. in the weight of the fruit, the average loss due to the trouble being calculated as 13.58 per cent. of the whole crop of a given tree. The disease also causes a decrease in the sugar content of the fruit and generally reduces the commercial grade.

None of the fungicides tested gave complete control of spotting, but

in 1937 trials two applications of 1 per cent. Bordeaux mixture, the first after blossoming and the second 15 days later, reduced the percentage of diseased fruit harvested from 91.9 in the untreated control to 78.3, the corresponding percentage for lime with sulphur (ground sulphur 1 to 1.5 parts, quicklime 1 to 1.5 parts, and water 100 parts) being 80.8.

HILDEBRAND (E. M.) & MILLS (W. D.). **Cherry yellows (physiological yellow leaf) in New York.**—*Phytopathology*, xxxi, 4, pp. 355–356, 1941.

Plant disease survey records at Cornell, New York State, reveal the presence of the so-called physiological yellow leaf of cherry [*R.A.M.*, xix, p. 30] every year since 1928, with heavy resultant defoliation in that year, 1931, 1935, 1937, and 1938, the date of the earliest appearance of the trouble ranging from 16th June to 6th July, and termination for the season usually occurring by 15th July. In Michigan and Wisconsin the symptoms of the disease and defoliation periods agree closely with those observed in New York, and there appears to be little doubt that the bud-transmissible cherry yellows virus is concerned in all the affected localities, though the character of the injuries sustained is somewhat milder in New York than in the more rigorous climate of Wisconsin.

HILDEBRAND (E. M.). **Cane gall of Brambles caused by *Phytomonas rubi* n.sp.**—*J. agric. Res.*, lxi, 9, pp. 685–696, 3 figs., 1940.

A study carried out in New York during the past seven years on cane gall of *Rubus* spp. [cf. *R.A.M.*, xv, p. 304] showed that the symptoms appear on the fruiting canes in May or June as small protuberances or elongate ridges of white granular gall tissue. The whitish eruptions rapidly increase in size and number and may entirely cover parts of the cane surface; they are most numerous on the lower part, but occur on the upper part, and on the small terminal branches. After some weeks the gall tissue turns brown, and starts to disintegrate near the soil surface. The enlargement of the galls often causes the stems to split open and the canes to dry out, canes so affected giving only small, seedy berries.

Inoculation with the organism isolated from the galls into fruiting canes, current-season cane growth and petioles, and roots readily induced gall formation. Small galls developed on the roots when the organism was introduced into the soil either directly or by means of water washing the organism off galls above the ground. Cultural, physiological, and morphological studies showed the causal organism, which is named *Phytomonas rubi* n.sp. (*Bacterium rubi* or *Pseudomonas rubi* according to other classifications), to be a Gram-negative, non-acid-fast rod, 1.7 by 0.6 μ , with rounded ends, mostly occurring singly or in pairs, occasionally in short chains in culture, and in chains and masses only in host tissue. It is a weak facultative anaerobe with optimum growth at 27°C.; the thermal death point is about 56°C. It is motile by subpolar flagella, and does not form spores. It does not liquefy gelatine, hydrolyse starch, reduce nitrates, or produce hydrogen sulphide or indol, but produces acid in milk, acid but no apparent gas

from arabinose, xylose, rhamnose, fructose, mannose, galactose, glucose, lactose, and erythritol; alkali but no apparent gas from melezitose, starch, inulin, pectin, lactositol, calcium gluconate, and formic, acetic, propionic, glycollic, malonic, succinic, tartaric, and malic acids, and yeast extract.

In New York the condition was observed in commercial plantings on black and purple raspberries [*Rubus occidentalis* and *R. neglectus*] and blackberries, and these hosts and raspberries were also successfully inoculated.

The disease is at present only of small importance and control measures for crown gall (*P. [Bacterium] tumefaciens*) are also effective against cane gall. The organism is apparently less able to survive in the soil than is *Bact. tumefaciens*.

McKNIGHT (T.). Water blister disease of Pineapples.—*Qd agric. J.*, lv, 3, pp. 180–182, 1941.

The author states that from the first week in January until the last week in April, 1940, reports were received in Queensland recording losses due to water blister [*Ceratostomella paradoxa*: *R.A.M.*, p. 460] in consignments of pineapples received in southern markets. Visits to 43 growers demonstrated conclusively that incidence is correlated with picking and packing-shed conditions, and that where the official control recommendations are carefully carried out the disease does not occur.

The factors governing incidence are the presence of pineapple refuse in and near the packing shed; the presence of handling wounds and growth cracks; delay in marketing; weather conditions before picking (warm, wet weather favouring the fungus, or wet following dry weather inducing cracks); temperature and humidity during transport; and injuries sustained after packing. February and March are the peak periods for losses, but growers should not relax their precautions between late December and the end of April. Control depends on observing the following recommendations: strict hygiene in and round the packing shed, and complete disinfection of the shed when warranted with 2 to 5 per cent. formalin solution; care in picking and handling; packing on the headlands when weather permits; avoiding the packing of fruit while still wet; avoiding transport delays; rigorous exclusion of all sunburnt or injured fruits; spraying all second-hand cases suspected of being contaminated with 2 per cent. formalin solution; and dusting the stem ends before packing with a mixture of one part benzoic acid and four parts kaolin, an additional precaution particularly recommended when weather conditions favour the disease. Experimental evidence failed to support the view (held by some growers) that fruits receiving heavy nitrogen applications are more susceptible than those given light ones.

RAMSBOTTOM (J.). Presidential address. The expanding knowledge of mycology since Linnaeus.—*Proc. Linn. Soc. Lond.*, 1938–9, pp. 280–367, 1941.

In his presidential address delivered to the Linnean Society of London held on 24th May, 1939, the author traced the gradual develop-

ment of ideas concerning the nature of fungi beginning with ancient Rome to recent times, with particular emphasis on the work of Linnaeus.

HOPKINS (J. C. F.). **Economic and domestic implications of plant diseases in Southern Rhodesia.**—*S. Afr. J. Sci.*, xxxvii, pp. 46–57, 1941.

The author discusses the effects on the economic system and domestic life of Southern Rhodesia of the principal diseases affecting crops of major importance in the Colony, namely, tobacco, maize, small cereals, fruit, and vegetables, with special reference to the first-named. It is contended that plant disease control should not be considered merely in the light of a specialized problem concerned exclusively with financial profit and loss, but as a vital factor in the production of the foodstuffs essential for the maintenance of physical fitness in individuals and efficiency in the nation as a whole.

HAUSAM (W.) & LIEBSCHER (E.). **Über Fleckenbildungen auf lohgerem Schafleder durch Mikroorganismen.** [On the spotting of tanned sheep's leather by micro-organisms.]—*Collegium, Haltingen*, 1940, pp. 506–508, 1940. [Abs. in *Chem. Zbl.*, cxii (i), 16, p. 2210, 1941.]

The presence on sheep's leathers treated with various synthetic tanning preparations and quebracho of grey- to brownish-purple spots or blotches was shown by further investigations at the Kaiser Wilhelm Institute for Leather Research, Dresden, to be due to *Dematium* [*R.A.M.*, xvi, p. 179], *Paecilomyces*, and probably a variety of other species of fungi. Figures are given of the damaged leathers and the mycelium and fructifications of the fungi concerned.

W. (C. M.). **Brown stains on the leaves of a stamp album.**—*Patra J.*, iii, 6, pp. 252–253, 1940. [Abs. in *Bull. Inst. Pap. Chem.*, xi, 6, p. 131, 1941.]

The appearance of the brown spots developing on the pages of a stamp album during storage suggested that they were due to 'foxing', a defect caused by mould growth associated in some way with the presence of iron [*R.A.M.*, xix, p. 635]. Microscopic examination confirmed this diagnosis, revealing both mould spores and iron, of which slightly more was detected in the spotted than in the clean areas of the paper. 'Foxing' can usually be removed by the treatment of the paper with a bleaching agent, e.g., sodium hypochlorite, but care is necessary to avoid deleterious effects. Liability to the defect may be minimized by the use of iron-free paper and storage in a dry place.

RHEA (H. E.). **The new electron microscope.**—*Science*, N.S., xciii, 2415, pp. 357–358, 1941.

A description is given of the new electron microscope now being manufactured by the RCA Manufacturing Company, Inc., which is capable of magnifications of 100,000 and affords a means not only of observing but also of photographing even some of the previously invisible filterable viruses.

D'OLIVEIRA (MARIA DE L.). **Os virus como parasitas.** [The viruses as parasites.]—*Rev. agron., Lisboa*, xxviii, 2, pp. 188–200, 1940.

This is a survey of some recent outstanding developments in the study of parasitic plant viruses, reference to most of which has already been made in this *Review*.

D'ANGREMOND (A.) & VAN HELL (W. F.). **Mycorrhiza van Hevea brasiliensis Müll.-Arg.** [Mycorrhiza of *Hevea brasiliensis* Müll.-Arg.]—Reprinted from *Versl. Ver. Proefst.-Personeel, Medan-Sumatra*, 1939, 16 pp., 6 figs., 1939. [English summary. Received June, 1941.]

Following a survey of outstanding contributions to the literature on mycorrhiza, a description is given of a typical endotrophic fungus occurring almost exclusively in the cortical tissues of the short, thick, yellowish-brown rootlets of *Hevea* rubber in the Dutch East Indies; entry being effected through the youngest tips, the root caps, root hairs, or even by way of the old epidermal cells. The hyphae are both intra- and intercellular, the former non-septate, swollen, multinuclear, and provided with vesicles and arbuscules [cf. *R.A.M.*, xviii, p. 469], and the latter septate, long, slender, and forming vesicles. Mycelial clumps develop in the cells during digestion. The organism resembles *Macrophomina phaseoli* [ibid., ix, p. 127], but its exact identity has not yet been demonstrated.

ARK (P. A.) & HUNT (MARJORIE L.). **Saprophytes antagonistic to phytopathogenic and other micro-organisms.**—*Science*, N.S., xciii, 2415, pp. 354–355, 1941.

A number of bacterial species antagonistic to phytopathogenic micro-organisms were isolated from soil, of which two, *Bacillus vulgatus* and one as yet unidentified yellow, spore-bearing bacillus, were studied in culture. The two antagonists were active against *Erwinia amylovora*, *E. aroideae*, *E. carotovora*, *E. phytophthora*, *Phytopomonas* [*Pseudomonas*] *campestris*, *P.* [*Bacterium*] *flaccumfaciens*, *P. insidiosa* [*Aplanobacter insidiosum*], *P.* [*Bact.*] *juglandis*, *P.* [*Bact.*] *lacrymans*, *P.* [*Bact.*] *malvacearum*, *P. michiganensis* [*A. michiganense*], *P.* [*Bact.*] *panici*, *P.* [*Bact.*] *pisi*, *P. sepedonica* [*Bact. sepedonicum*], *P.* [*A.*] *stewarti*, *P.* [*Bact.*] *tumefaciens*, *Fusarium graminearum* [*Gibberella saubinetii*], *F.* [*bulbigenum* var.] *lycopersici*, *Dematophora* [*Rosellinia*] *necatrix*, *Helminthosporium sativum*, *Verticillium albo-atrum*, and *Phytophthora* sp., as well as several non-pathogenic organisms. The bactericidal substances produced by the two species were water-soluble and active in extremely small quantities; that of *B. vulgatus* was adsorbed by all Berkefeld filters but passed through a Chamberland L 3, while that of the yellow bacillus was retained by both types of filter; neither was destroyed by boiling for 60 minutes. In the autoclave, the bactericide of the yellow bacillus was inactivated after 15 minutes at 10 lb. pressure, while that of *B. vulgatus* was still active after 10 minutes at 20 lb. pressure. The strongest antagonism was displayed in media containing dextrose and fructose, while none was observed on a peptone sugar-free medium or in a nutrient medium plus maltose. All attempts to precipitate the active principle from cultural solutions were unsuccessful,

but it was possible to concentrate the bactericidal material by evaporating the culture media to dryness in a double boiler. Further studies on this phase of the work are in progress.

W. (L. G. G.). **Cracking of Potato tubers.**—*Gdnrs' Chron.*, Ser. 3, cix, 2841, p. 223, 1941.

The writer has observed cracking in large Ally and Majestic potato tubers within 24 hours of lifting, the crop being dug before the attainment of full maturity and during a late summer drought [cf. *R.A.M.*, xv, p. 820]. Such tubers, on exposure to the dry air, presumably lose water from their superficial tissues at such a rate as to disturb the equilibrium between the central and outer tissues, the tension in the peripheral zones resulting from stretching by the turgid inner region being relieved by the development of fissures.

JEHLE (R. A.). **Potato disease control studies on the Maryland Eastern Shore.**—*Bull. Md agric. Exp. Sta.* 443, pp. 273-316, 6 figs., 1940.

In a comprehensive series of investigations on the control of the potato diseases prevalent in the Eastern Shore region of Maryland, the following results were obtained.

No significant difference was found in the percentage incidence of virus diseases in plots grown from seed stocks maintained at different storage temperatures. Renewal of the seed stock at least every other year, or, better, every year, is necessary for the production of good late-grown Irish Cobbler Eastern Shore seed stock. Only registered seed or certified seed grown in fields practically unaffected by virus diseases is safe for the renewal of late Eastern Shore-grown seed stock.

Tubers from the early Eastern Shore crop can be used for planting the late seed crop if the cut tubers are soaked for one hour in a solution of sodium thiocyanate (1 lb. to 12 gals. of water) and planted at once. Repetition of the treatment for two successive years, however, greatly increased the percentage of leaf roll in Warba seed stock in spite of roguing. Virus disease control would be a matter of some difficulty if the practice of growing late seed crops from treated, spring-grown seed became general locally.

All local growers are advised to spray the vines, for the control of early blight [*Alternaria solani*], flea beetles, and leafhoppers, with Bordeaux mixture (4-4-50) plus 2 lb. calcium arsenate per 50 gals., beginning when the plants are 6 in. high or less, repeating about two weeks later, and following with applications at seven- to ten-day intervals until the vines are mature. If spraying is impracticable, dusting with monohydrated copper-lime dust may be substituted.

PARRIS (G. K.) & JONES (W. W.). **Studies on the nature of spindling sprout of Potato.**—*Phytopathology*, xxxi, 4, pp. 340-346, 1 fig., 1941.

Investigations were undertaken to determine the nature of spindling or hair sprout of potato [*R.A.M.*, xvii, p. 700], which was present to an appreciable extent in consignments of Bliss Triumph tubers imported into Hawaii from North Dakota and elsewhere in the United

States during the autumn of 1937. The condition in question is herein defined as 'the premature production of thread-like sprouts by tubers'.

The disease is not transmissible by grafting. The grafting of normal tubers with cores from affected ones results in a stimulation of the eyes of the former with consequent production of an abnormally large number of healthy stems. Eyes from sound tubers grafted into diseased ones produce shoots of normal foliar and stem habit. The following were the numbers of sprouts per plant and yield in lbs. per 50 plants of (1) normal tubers, (2) the same grafted with spindling-sprout cores (graft A), (3) spindling-sprout tubers grafted with normal cores (graft B), and (4) spindling-sprout tubers: (1) 2.36 ± 0.24 and 33.7 ± 3.8 , respectively; (2) 4.60 ± 0.24 and 41.2 ± 3.8 , respectively; (3) 6.15 ± 0.38 and 12.8 ± 4.4 , respectively; and (4) 13.78 ± 0.35 and 8.9 ± 5.4 , respectively. The difference in yield between (1) and (2) and that between (3) and (4) are not statistically significant, but there was a significant reduction in yield due to spindling sprout. Of the hills developed from graft A, 93.4 per cent. produced normal tubers, 4.6 per cent. the same but prematurely sprouted, and 2 per cent. under-sized (but not 'spindly'), precociously sprouted tubers. A test indicated that it may be possible to eliminate spindling sprout from an affected population by the selection at harvesting of non-sprouted tubers over $\frac{1}{2}$ in. in diameter.

Chemical analyses of diseased and healthy tubers from the same bag of seed revealed in the former higher concentrations of reducing sugar, sucrose, acid-hydrolysable substances, soluble nitrogen, ammonia, and amino nitrogen than in the latter, the differences between the two lots in regard to the first two fractions being of possible significance. Spindling sprout may be related to an inability of the apical meristems of the buds of a tuber to synthesize proteins.

HOLMBERG (C.). *Potatiskräftans bekämpande och Potatissortfrågan.*

1. *Potatiskräftans utbredning och statliga åtgärder.* [Potato wart control and the question of Potato varieties. 1. Potato wart distribution and State precautions.]—*Landtmannen, Uppsala*, xxv, 8, pp. 149–150, 1 fig., 1 map, 1941.

The present situation as regards the geographical distribution of potato wart [*Synchytrium endobioticum*] in Sweden and the measures enforced by the State for its control are summarized [*R.A.M.*, xiv, pp. 672, 787; xv, p. 608]. Blekinge and Halland are the two provinces containing the maximum number of infection foci, 271 being counted in the former and 241 in the latter from 1928 to 1936 and the following additions being made in 1937, 1938, 1939, and 1940; Blekinge 18, 13, 21, and 3, respectively; Halland 6, 9, 17, and 1, respectively. For the entire country the numbers of new cases detected in 1936, 1937, 1938, 1939, and 1940 were 179, 90, 103, 77, and 107, respectively. The infected areas are under the supervision of the Plant Protection Institute, inspections being made as a rule every summer. Owing to the longevity of the resting spores of *S. endobioticum*, the viability of which extends over a minimum period of 15 years in the soil, the restrictions relating to such areas must necessarily be maintained until all risk of a recrudescence of the disease is at an end. Some details are given of

the mode of dissemination of the fungus by commerce in diseased stocks, use of contaminated implements and the like, and omission to notify fresh cases. [An account by the same author of the distribution of potato wart disease in Sweden also appears in *Värtskyddsnotiser, Värtskyddanst., Stockh., 1941*, 2, pp. 23-27, 1 map, 1941.]

Potato blight. What have we to expect, and what are we going to do about it in 1941?—4 pp., 1 diag., issued by Seale-Hayne Agricultural College, Newton Abbot, Devon, [1941].

In this useful leaflet simple directions are given to growers on the control of potato blight [*Phytophthora infestans*] by spraying and dusting. The disease is estimated to produce in Devon and Cornwall an average loss of two tons of ware per acre, which could be almost completely prevented by spraying.

LEHMANN (H.). **Untersuchungen über die Genetik und Physiologie der Resistenz der Kartoffel gegen *Phytophthora infestans* de Bary. Die genetische Analyse der Resistenz von *Solanum demissum* sp. (vorl. Mitteilung).** [Studies on the genetics and physiology of the resistance of the Potato to *Phytophthora infestans* de Bary. The genetic analysis of the resistance of *Solanum demissum* sp. (preliminary note).]—*Züchter*, xiii, 2, pp. 33-34, 1 fig., 1941.

In potato-breeding investigations at the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, Mark, the author used as parents nine forms of *Solanum demissum*, selected as homozygous for complete resistance or susceptibility to potato blight (*Phytophthora infestans*) [*R.A.M.*, xvii, p. 765], all lines showing intermediate or graduated reaction being rejected. The reactions of these forms were as follows: *S. demissum* El Desierto, resistant to races 8 and 5 of the fungus, *S. d. tlaxephualcoense*, resistant to both races, *S. d. Redd. v. Pr.*, *S. d. utile*, and *S. d. Buk. 029* all susceptible to 8, resistant to 5, *S. d. xillense*, *S. d. Redd. 519*, *S. d. Buk.*, and *S. d. Rio Frio*, the four last-named susceptible to both races of *P. infestans*. The F_1 plants arising from all crosses, involving 16 different combinations (nine reciprocal) were uniformly resistant. In the F_1 segregation took place on a 3 : 1 basis, in back-crosses of the F_1 with the resistant parent the F_1 seedlings proved uniformly resistant, while in similar crosses with the susceptible parent the progeny segregated in a ratio of 1 : 1. The total number of seedlings analysed was about 23,000, comprising 2,000 parents and 3,500, 11,500, and 6,000 of the F_1 , F_2 , and F_2' generations, respectively. On the basis of these data it may be confidently asserted that the resistance of the 72-chromosome *S. demissum* to late blight is inherited in a dominant manner and rests on a single Mendelian gene, the mode of transmission being identical in respect of both races of the fungus used in the tests.

HAWKES (J. G.). **Potato-collecting expeditions in Mexico and S. America.** 30 pp., 1 fig., 4 graphs, 2 maps, Cambridge, Imp. Bur. Pl. Breed., 1941. 3s. 0d.

An interesting account is given of the expeditions organized by the Imperial Agricultural Bureaux for the purpose of collecting indigenous

wild and cultivated potatoes in Mexico and South America in 1938-9 under the leadership of E. K. Balls. One of the most important objects of the survey was the collection of disease-resistant types, and tests still in progress with the material collected indicate that quite a high proportion of the Mexican species are highly resistant to, or immune from, late blight (*Phytophthora infestans*) [*R.A.M.*, xx, p. 130] in the laboratory. For the first time absolute immunity has been found in a very prolific diploid species, *Solanum lanciforme*, which is far superior in this respect to the two tetraploids *S. antipoviczii* and *S. ajuscoense*. So far, none of the South American material has given evidence of resistance to late blight.

According to Bukasoff, the Russian geneticist who paid several visits to Mexico and South America of recent years, resistance to wart disease (*Synchytrium endobioticum*) is fairly common among potato varieties from the latter region, but at present only a small proportion of the material from the Empire expedition has been tested from this point of view.

Bukasoff further maintains that *S. rybinii*, a diploid Colombian species, possesses a high degree of resistance to virus diseases, and more than 30 samples of diploid types related to this species and *S. boyacense* are now available for study.

BOTTOMLEY (A[VERIL] M.). Potato-tuber diseases: common scab and Rhizoctonia.—*Fmg S. Afr.*, xvi, 181, p. 141, 1941.

Potato scab (*Actinomyces scabies*) and *Rhizoctonia* disease (*R. [Corticium] solani*) are both very prevalent in South Africa, and as seed potatoes are likely to be scarce during the coming season, it is possible that some diseased seed may be planted. Growers are, accordingly, strongly advised to disinfect all tubers showing even a trace of infection. The method recommended is to place the uncut potatoes in boxes, dip them in water, drain them, keep them moist for 12 to 24 hours, then dip them for two hours in mercuric chloride solution (4 oz. per 30 gals.) drying immediately. Treatment should be effected before the tubers have sprouted and at least two weeks before planting. The solution may be used three times only for lots up to 60 lb. With lots up to 4 bush. $\frac{1}{2}$ oz. of mercuric chloride and sufficient water to restore the solution to its original volume may be added after each treatment up to eight.

VALLEAU (W. D.). Powdery mildew of Potato in Kentucky.—*Phytopathology*, xxxi, 4, pp. 357-358, 1941.

The older shoots of seedling potato plants at the Kentucky Agricultural Experiment Station were observed in the autumn of 1940 to bear powdery masses of conidia, 25.5 to 38.2 by 10.9 to 18.2 (average 32.8 by 13.8) μ , which were succeeded before the death of the foliage by dark brown perithecia, 127 to 136 μ in diameter, furnished with indeterminate hypha-like appendages, and containing predominantly bisporulate, stalked asci, 54.5 to 72.7 by 25.5 to 36.4 (59.1 by 31.4) μ , the ascospores measuring 16.4 to 27.3 by 10.9 to 20 (21.3 by 13.8) μ . The fungus was tentatively identified as *Erysiphe cichoracearum* [*R.A.M.*, xv, p. 604] by the writer, and J. A. Stevenson also assigned the fungus to this species.

TULLIS (E. C.) & CRALLEY (E. M.). **Longevity of sclerotia of the stem-rot fungus *Leptosphaeria salvinii*.**—*Phytopathology*, xxxi, 3, pp. 279–281, 1941.

The sclerotia of the rice stem rot fungus, *Leptosphaeria salvinii*, were found to remain viable in uncultivated rice soil in Arkansas for at least six years [*R.A.M.*, xiii, p. 395; xvii, p. 128; xviii, p. 815]. Sclerotia recovered from stubble (a) in the field and (b) stored in the laboratory were still viable after 2 and 2½ years, respectively. It is apparent, therefore, that the disease cannot be eliminated by rotation periods of four to six years.

ORIAN (G.). **Hosts of the Sugar Cane gumming disease organism.**—*Rev. agric. Maurice*, xx, 1, pp. 19–58, 7 pl., 1941. [French summary.]

Most of the information in this comprehensive survey of the natural and artificial host range of the agent of gumming disease of sugar-cane (*Bacterium vasculorum*) in Mauritius has already been summarized [*R.A.M.*, xviii, p. 374], but coco-nut should be added to the list of plants reacting positively to inoculation with the pathogen, and the giant bamboo, erroneously designated *Dendrocalamus giganteus* in a previous paper, is herein identified as *Bambusa vulgaris*. Certain slight differences in the morphological and cultural characters of the organism isolated from *Thysanolaena maxima* [*T. agrostis* Nees] indicate that it belongs to a strain distinct from those of sugar-cane, *Dictyosperma album*, and probably also of maize. The dimensions of the rods from sugar-cane, *D. album*, and *T. agrostis* are given as 1.4 by 0.5 μ , 1.3 by 0.45 μ , and 1.2 by 0.5 μ , respectively.

ZEROVA (Mme M. Y.). Декілька нових для СССР видів **Phomopsis**. [Some species of *Phomopsis* new to the U.S.S.R.]—*J. Bot. Acad. Sci. Ukr.*, i, 2, pp. 305–309, 1940. [English summary.]

Descriptions are given of 12 species of *Phomopsis* new to the U.S.S.R., including five new to science [with Latin diagnoses of the latter], of which the following may be mentioned: *P. [Diaporthe] perniciosa* on peach, *P. perseae* n.sp. on avocado, and *P. diospyri* n.sp. on *Diospyros lotus*.

PILÁT (A.). **Revision der Gattung *Lentinus* Fr. aus dem Herbar des Naturhistoriska Riksmuseet in Stockholm.** [A revision of the genus *Lentinus* Fr. from the herbarium of the State Natural History Museum in Stockholm.]—*Ann. mycol., Berl.*, xxxix, 1, pp. 71–103, 1941.

A critically annotated list is given of 106 species of *Lentinus* represented in the herbarium of the Stockholm Natural History Museum, including one new one, *L. samarensis* [with a Latin diagnosis], on wood in the Philippines, and six new varieties. Three recently described genera, viz., *Lentinopanus* Pilát 1935 = *Panus* (Fr.) emend. Singer 1936, *Lentinellus* (Karst.) emend. Kühner 1934, and *Lentinaria* Pilát 1940, between them accommodate the species formerly assigned to *Lentinus* but now excluded from the genus in its amended form.

UNAMUNO (L. M.). **Notas micológicas. XIV. Contribución al estudio de los Uredinales y Ustilaginales de la flora española.** [Mycological notes. XIV. A contribution to the study of the Uredinales and Ustilaginales of the Spanish flora.]—*Bol. Soc. esp. Hist. nat.*, xxxviii (1940), pp. 19–36, 5 figs., 1941.

In this further instalment of the author's geographical and taxonomic studies on the Spanish mycoflora [*R.A.M.*, xvii, p. 415] are enumerated 41 rusts and 13 smuts, the former including two new species (*Puccinia ateridoi* on *Dianthus toletanus* and *P. rodriguezii* on *Aster acris* var. *glutinosa*), *P. menthae* on *Mentha longifolia* [*ibid.*, xvii, pp. 485, 771; xix, p. 730], *Uromyces betae* on beet, and *Gymnosporangium sabinae* [*ibid.*, xx, p. 24] on pear, and the latter *Ustilago cynodontis* on *Cynodon dactylon*, *U. zaeae* on maize, and *Tilletia foetens* [*T. foetida*] and *T. tritici* [*T. caries*] on wheat.

BONDARTZEFF (A.) & SINGER (R.). **Zur Systematik der Polyporaceen.** [A contribution to the systematics of the Polyporaceae.]—*Ann. mycol.*, Berl., xxxix, 1, pp. 43–65, 1941.

In this paper the authors present their classification of the Polyporaceae sensu lat. They apply to the group the principles previously adopted in Singer's 'Das System der Agaricales', and accordingly give full weight to characters derived from micro-anatomy and cell-chemistry. The diagnoses of the new genera, here given by name only, are expected to appear shortly in *Sovetsk. Bot.*

WINDISCH (S.). **Entwicklungsgeschichtliche Untersuchungen an Torulopsis pulcherrima (Lindner) Saccardo und Candida tropicalis (Castellani) Berkhout. Ein Beitrag zur Systematik der Gärungsmonilien.** [Phylogenetic studies on *Torulopsis pulcherrima* (Lindner) Saccardo and *Candida tropicalis* (Castellani) Berkhout. A contribution to the taxonomy of the fermentation Moniliae.]—*Arch. Mikrobiol.*, xi, 4, pp. 368–390, 6 figs., 1940.

Ascus formation was observed in the strains of *Torulopsis pulcherrima* isolated in pure culture by the writer [? in Germany] from pressed yeast, cherries, and gooseberries [*R.A.M.*, xviii, p. 259] and of *Candida tropicalis* [*ibid.*, xx, p. 258] from the first-named substratum. In both species the asci are developed from bud-like mother cells and contain four spores, uniformly averaging 3 by 2 μ . The ascogenous stages of the two yeasts developed best in Winge-Ranvier chambers (*C.R. Lab. Carlsberg*, Sér. physiol., xxi, p. 77, 1935) or covered concave slides sealed with vaseline. Sporulation occurred in profusion on all the solid and liquid media used, but the membrane enveloping the spores tends to obscure the process. The ascospores do not germinate by means of a hypha, but immediately give rise by budding to small daughter cells, which in *C. tropicalis* develop by unknown means into larger binucleate vegetative cells. In *T. pulcherrima* the fusion of the ascospore daughter cells was observed, the smaller of the two merging into the larger and in turn giving rise to a daughter cell, constituting the first blastospore or point of departure for all further vegetative forms, among which chlamydospores soon become differentiated. These may multiply by

blastospore budding or form asci which either remain sessile or become detached, in either case producing four spores; the former tendency predominated in, but was not confined to, solid media.

All the vegetative forms, as well as the ascus mother cells, were shown by the Winge-Feulgen staining technique to be binucleate, a character which, taken in conjunction with the ascospore budding, suggests far-reaching analogies with the Exoasceae. On the basis of these researches the author proposes to (a) incorporate *T. pulcherrima* in the genus *Candida* as *C. pulcherrima*, and (b) to unite all candidoid fungi of similar development in the new family of Candidaceae, to be interpolated in the order Exoascales.

BOND (T. E. T.). **Potash deficiency in Tea cultivation.**—*Tea Quart.*, xiii, 4, pp. 139–145, 1940.

This is a review of the recent paper by de Haan and Schoorel on potash deficiency in the tea plantations of Java and Sumatra, already noticed from the original source [*R.A.M.*, xx, p. 83], with an addendum by T. Eden (pp. 146–147) stating that the situation in Ceylon in this respect is much less critical, nine years' omission of potash from the fertilizer having neither diminished the flush or wood yield nor reduced (over a six-year period) the foliar diagnosis figure to the deficiency level.

BAWDEN (F. C.). **The serological reactions of viruses causing Tobacco necrosis.**—*Brit. J. exp. Path.*, xxii, 2, pp. 59–70, 1 fig., 1941.

The serological studies on tobacco necrosis herein described were conducted at the Rothamsted Experimental Station, for the most part with two stocks, one originally supplied by K. M. Smith in 1936 and since maintained at Rothamsted, and the second (also furnished by K. M. Smith) directly descended from that used by Pirie *et al.* in 1938 [*R.A.M.*, xviii, p. 416], which are referred to as the Rothamsted and Cambridge cultures, respectively. Both the cultures produced apparently identical symptoms on White Burley tobacco and Canadian Wonder French beans (*Phaseolus vulgaris*), but when rubbed on opposite halves of the same leaves the Rothamsted inoculum caused the formation of rather more lesions than the Cambridge material on beans and somewhat fewer on tobacco.

Evidence is presented to show that tobacco necrosis is a disease that can be caused by a number of serologically unrelated viruses, which possess similar physical properties. This is the first record of viruses with no common antigen being able to cause identical symptoms in plants, although the phenomenon was known among animal viruses. From a few tests it appears that most naturally occurring tobacco necrosis is caused by virus mixtures. It is suggested that these viruses are composed of particles of different sizes, and that they may differ in stability. The effects of heating, ageing, and alkali treatment on tobacco necrosis appear to involve intramolecular changes in the virus particles, whereas in the case of potato virus X the particles tend to undergo disruption under the influence of such treatments.

KINCAID (R. C.). **A copper-soap spray for control of Tobacco downy mildew.**—*Phytopathology*, xxxi, 3, pp. 286–288, 2 figs., 1941.

Excellent control of tobacco downy mildew (*Peronospora tabacina*) on transplants in the field is stated to have been obtained in Florida by the application at three-day intervals from 4th to 16th May at the rate of 50 gals. per acre of half-strength flordo (a copper sulphate-soap mixture normally used at the full strength of 3½ lb. to 14 lb. soap per 100 gals.) [*R.A.M.*, xvii, p. 51]. On sprayed leaves water spread into a thin, quickly drying film and this would reduce the likelihood of infection by the fungus.

VAN KOOT (Y.). **Virusreinigung und ihre Lehren über die Art des Virus.** [Virus purification and its teaching concerning the nature of the virus.]—*Tijdschr. PlZiekt.*, xlvi, pp. 97–126, 1940.¹ [Dutch. Abs. in *Chem. Zbl.*, cxii (1), 18, p. 2399, 1941.]

The following methods of purification were applied to tobacco mosaic and single virus streak of tomato at the Wageningen Mycological Laboratory: (1) Stanley's filtration through celite and separation of the virus by repeated precipitation with ammonium sulphate [*R.A.M.*, xiv, p. 721; xv, p. 177, *et passim*]; (2) Bawden and Pirie's heating to 70° C. and separation of the virus after chemical treatment [*ibid.*, xvii, p. 564]; and (3) Ryjkoff's and Gromyko's elimination of the pigments by means of animal charcoal [*ibid.*, xviii, p. 415]. A rapid chemical method for the purification of relatively pigment-free juice consists in filtration through celite, virus precipitation with 40 per cent. ammonium sulphate, and only one treatment with 1 or 2 per cent. charcoal, all at P_H 7. The needles of the tomato single virus streak are slightly shorter (15 μ) than those of tobacco mosaic (20 to 25 μ). The virulence of the tomato virus, as measured by local lesions on *Nicotiana glutinosa*, remained intact during a protracted process of chemical purification, whereas that of tobacco mosaic declined appreciably.

MAY (C.), WALTER (J. M.), & MOOK (P. V.). **Rosy canker of London Plane associated with illuminating gas injury.**—*Phytopathology*, xxxi, 4, pp. 349–351, 1 fig., 1941.

Since 1939 London plane [*Platanus acerifolia*] trees in Maryland, New York, and New Jersey have been observed to bear on the branches and trunks irregular, mostly elongated cankers of a very striking appearance, their furrowed, hypertrophied, more or less decorticated centres being composed of rosy to brown proliferated tissues, up to ½ in. thick, the consistency being reminiscent of the flesh of a water-melon in the early stages, subsequently turning hard and brown. The top of the stump of one severely cankered tree showed brownish-pink spots in the wood of a few of the outer annual increments and scattered, diffuse pink spots nearer the centre. Some branches 1 in. in diameter showed a pale pink discoloration of the inner bark and of the cambial region 20 ft. from the nearest recognizable canker. Platings from the diseased tissues and discoloured wood have yielded no micro-organisms, and the cankers are believed to be a response to the escape of illuminating gas into the soil near the trees.